REGISTER

OF

THE LEHIGH UNIVERSITY,

1894-1895.

SOUTH BETHLEHEM, PA.
1894.

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THE LEHIGH UNIVERSITY,

SOUTH BETHLEHEM, PA.

1894-1895.

FOUNDED BY ASA PACKER.

BETHLEHEM, PA.:
TIMES PUBLISHING COMPANY.
1894.

TABULAR ALMANAC.

1894.

JULY.

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	...	...	...	...
...	...	...	...	...	...	...

AUGUST.

S	M	T	W	T	F	S
...	...	...	1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	...
...	...	...	...	...	...	...

SEPTEMBER.

S	M	T	W	T	F	S
...	...	...	...	...	...	1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	...	...	...	...	...	...

OCTOBER.

S	M	T	W	T	F	S
...	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31	...	...	...
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NOVEMBER.

S	M	T	W	T	F	S
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11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	...
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DECEMBER.

S	M	T	W	T	F	S
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9	10	11	12	13	14	15
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1895.

JANUARY.

S	M	T	W	T	F	S
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6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31	...	...
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FEBRUARY.

S	M	T	W	T	F	S
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10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	...	...
...	...	...	...	...	...	...

MARCH.

S	M	T	W	T	F	S
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10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
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APRIL.

S	M	T	W	T	F	S
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MAY.

S	M	T	W	T	F	S
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JUNE.

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JULY.

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AUGUST.

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SEPTEMBER.

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OCTOBER.

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NOVEMBER.

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DECEMBER.

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1896.

JANUARY.

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12	13	14	15	16	17	18
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FEBRUARY.

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MARCH.

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APRIL.

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MAY.

S	M	T	W	T	F	S
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JUNE.

S	M	T	W	T	F	S
...	1	2	3	4	5	6
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14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	...	...	...	...
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CALENDAR.

1894.		1894-1895.
Sept. 8, 10, 11,	Saturday, Monday, and Tuesday,	Examinations for Admission.
Sept. 12,	Wednesday, . .	First Term begins.
Oct. 11,	Thursday, . .	Founder's Day.
Nov. 29,	Thursday, . .	Thanksgiving Day.
Dec. 19,	Wednesday, .	First Term ends.
1895.		
Jan. 8, 9,	Tuesday and Wednesday,	Examinations for Admission to Second Term.
Jan. 9,	Wednesday, .	Second Term begins.
Jan. 19,	Saturday, . .	Junior Prize Orations due.
Feb. 27,	Wednesday, .	Ash Wednesday.
Feb. 22,	Friday, . .	Washington's Birthday.
April 11,	Thursday, . .	Easter Holidays begin.
April 16,	Tuesday, . .	Easter Holidays end at $8\frac{1}{4}$ A.M.
May 27,	Monday, . .	University Day Orations due.
May 29,	Wednesday, . .	Theses of Seniors due.
May 29,	Wednesday, .	Senior Examinations begin.
June 10,	Monday, . . .	Annual Examinations begin.
June 16,	Sunday, . .	Baccalaureate Sermon.
June 17,	Monday, . . .	Class Day.
June 19,	Wednesday, .	University Day.
Jun. 20, 21, 22,	Thursday, Friday, and Saturday,	Examinations for Admission.

1895.		1895-1896.
Sept. 7, 9, 10,	Saturday, Monday, and Tuesday,	Examinations for Admission.
Sept. 11,	Wednesday, . .	First Term begins.
Oct. 10,	Thursday, . .	Founder's Day.
Nov. 28,	Thursday, . .	Thanksgiving Day.
Dec. 18,	Wednesday, .	First Term ends.
1896.		
Jan. 7, 8,	Tuesday and Wednesday,	Examinations for Admission to Second Term.
Jan. 8,	Wednesday, . .	Second Term begins.
June 17,	Wednesday, .	University Day.

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*President Robert A. Lamberton, LL.D., died September 1, 1893, and, as provided by the Rules of the University, his place is filled *ad interim* by the Senior Professor.

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Sci.—Science and Letters.
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C.E.—Civil Engineering.
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M.E.—Mechanical Engineering.
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Eugene Mowlds,	C.E.,	West Conshohocken.
William Spencer Murray,	E.E.,	Annapolis, Md.
Robert Neilson, Jr.,	C.E.,	Williamsport.
Walter R. Okeson,	C.E.,	Bethlehem.
Charles B. Pennell,	M.E.,	Duncannon.
James Harry Philips,	C.E.,	Atglen.
*Joseph Phillips, Jr.,	E.M.,	Nashville, Tenn.
John Livingston Poultney,	M.E.,	Baltimore, Md.
Henry Crider Quigley,	E.E.,	Harrisburg.
William Reinecke, Jr.,	Arch.,	Louisville, Ky.
Eugene Jesse Rights,	C.E.,	Tahlequah, Ind. T'y.
Herbert Timothy Rights,	C.E.,	Tahlequah, Ind. T'y.
*Samuel Neely Riter,	M.E.,	Pittsburg.
Eugene Schwinghammer,	E.E.,	Washington, D. C.
Harry Kent Seltzer,	C.E.,	Ephrata.
John Egbert Shero,	A.C.,	Fredonia, N. Y.
Robert S. Siegel,	Clas.,	Bethlehem.
Edwin Harrison Sigison,	E.E.,	Buffalo, N. Y.
John Blake Slack,	E.E.,	Paducah, Ky.
Robert Eugene Smith,	M.E.,	West Bethlehem.
Edward George Steinmetz,	E.E.,	Philadelphia.
John Eugene Stocker,	Sci.,	Bethlehem.
Herbert Ridley Stratford,	A.C.,	Jersey City, N. J.
Robert Melvin Tarleton,	E.M.,	Baltimore, Md.

*Not clear of conditions.

	Course.	Residence.
Robert Sayre Taylor,	Sci.,	Bethlehem.
*Nathaniel Thurlow,	A.C.,	Lancaster.
Charles Frederick Townsend,	Arch.,	Willimantic, Conn.
Joseph Boyer Townsend,	E.E.,	Venetia.
*Frederick John Van Benthem van den Bergh,	C.E.,	Arnhem, Holland.
Willard Randolph Van Liew,	E.M.,	Neshanic, N. J.
*Geo. Brinkerhoff Van Riper,	A.C.,	Rutherford, N. J.
Charles Henry Vansant,	C.E.,	Eddington.
William Warr,	E.E.,	Philadelphia.
Harry Dallam Webster,	M.E.,	Baltimore, Md.
Fred Irving Wheeler,	C.E.,	Pawtucket, R. I.
Harry Amasa White,	E.E.,	Philadelphia.
John Crum Whitmoyer,	E.E.,	Harrisburg.
Edward Newton Wigfall,	A.C.,	Philadelphia.
John Marion Wilson,	C.E.,	Hillsboro, Md.
Harold Lawden Wood,	A.C.,	Upper Montclair, N.J.
*Carlos Yglesias,	E.M.,	San José, Costa Rica,
†Harry Bernard Zimmele,	A.C.,	Bethlehem. [C.A.

JUNIOR CLASS.

William James Adams,	E.E.,	Harrisburg.
William Stewart Ayars,	M.E.,	Wilkes-Barre.
Hobart Bentley Ayers,	M.E.,	Westerly, R. I.
Albert Doane Ayres,	C.E.,	Williamsport.
Arthur Davison Badgley,	E.E.,	South Bethlehem.
Francis Hoskins Baldwin,	E.E.,	New Haven, Conn.
Hasell Wilson Baldwin,	M.E.,	Zanesville, O.
Lewis Warrington Baldwin,	C.E.,	Waterbury, Md.
Springfield Baldwin,	C.E.,	Baltimore, Md.
Geo. Pomeroy Bartholomew,	E.M.,	Jeanesville.
*Frederic Bartles,	C.E.,	Williamsport.
Charles C. W. Bauder,	E.E.,	Rheims, N. Y.
Fairfax Bayard,	C.E.,	Washington, D. C.
James George Beach,	Arch.,	Apalachin, N. Y.
Herbert Huebener Beck,	A.C.,	Lititz.

*Not clear of conditions.
†Excused.

	Course.	Residence.
Samuel Edward Beeler,	M.E.,	Hagerstown, Md.
*Edgar Tweedy Belden,	C.E.,	Stamford, Conn.
*Moriz Bernstein,	C.E.,	Philadelphia.
Warren Joshua Bieber,	Clas.,	Bethlehem.
Daniel William Bliem,	C.E.,	Pottstown.
*Benjamin Franklin Bossert,	C.E.,	Phœnixville.
Howard Franklin Boyer,	Sci.,	Springtown.
Edward Elisha Bratton,	C.E.,	Lewistown.
Frank Shepard Bromer,	M.E.,	Schwenksville.
Maximilian Joseph Bucher,	A.C.,	Columbia.
George Amandus Buvinger,	M.E.,	Dayton, O.
Aaron Beaumont Carpenter,	E.E.,	Avondale.
Malcolm Carrington,	E.E.,	Richmond, Va.
Frank Leslie Cooke,	E.E.,	Hackettstown, N. J.
Eckley Samuel Cunningham,	M.E.,	Drifton.
Samuel Philip Curtis,	M.E.,	Penn Yan, N. Y.
Frederick Allyn Daboll,	C.E.,	Plainfield, N. J.
John William Dalman,	M.E.,	Fort Wayne, Ind.
Lewis Benjamin Davenport,	C.E.,	Baltimore, Md.
*Robert Adriance Davidson,	E.E.,	Northport, L. I.
Samuel Moses Dessauer,	Arch.,	Montrose.
William Carter Dickerman,	M.E.,	Milton.
Benjamin Irvin Drake,	E.M.,	South Bethlehem.
Frank Oliver Dufour,	C.E.,	Mitchellsville, Md.
Edward Miall Durham, jr.,	C.E.,	Vicksburg, Miss.
Edward Hiram Dutcher, jr.,	M.E.,	South Meriden, Conn.
Timothy Sharpe Eden,	E.E.,	Brown's Town, Jamai-
George Ramsey Enscoe,	C.E.,	Bennett P. O. [ca.
William Alvin Evans,	E.M.,	Summit Hill.
Charles Victor Ferriday,	M.E.,	South Bethlehem.
*Charles Albert Andrew Fink,	M.E.,	Yonkers, N. Y.
Clarence Richard Fountain,	E.E.,	Good Hope, D. C.
Thomas Joseph Gannon,	M.E.,	South Bethlehem.
James Brown Given,	E.E.,	Carlisle.
*John Savage Graff,	E.E.,	Williamsport.
†William Heald Groverman,	M.E.,	Oakland, Md.

*Not clear of conditions.
†Excused.

	Course.	Residence.
David Hall,	E.E.,	Fayetteville, Tenn.
Harry N. Herr,	C.E.,	Wheatland Mills.
Howard Drysdale Hess,	M.E.,	Philadelphia.
*Oliver Zell Howard,	M.E.,	Hagerstown, Md.
Robert Parsons Howell,	C.E.,	Blairstown, N. J.
*William Thomas Hutchins,	C.E.,	Wyoming.
William Steell Jackson,	E.E.,	Duncannon.
*James Keys,	C.E.,	Conshohocken.
Victor Witmer Kline,	C.E.,	Lockport, N. Y.
*Robert Edwin Kresge,	A.C.,	South Bethlehem.
Robert Edward Laramy,	Clas.,	Bethlehem.
*Telford Lewis,	E.M.,	Blairsville.
*Sterling Catlin Lines,	E.E.,	Wilkes-Barre.
Bruce Emerson Loomis,	E.E.,	Wilkes-Barre.
Caleb Wheeler Lord,	M.E.,	Lebanon.
Clifford Sherron MacCalla,	E.E.,	Philadelphia.
James Gordon Mason,	E.M.,	West Pittston.
Victor Emanuel Masson,	A.C.,	Hammondsport, N. Y.
Edward Williamson Miller,	E.M.,	Bethlehem.
Elmer Wesley Mitchell,	C.E.,	Fall River, Mass.
Rafael de la Mora,	M.E.,	Guadalajara, Mex.
Charles Howard Morgan,	E.E.,	Maxatawny.
*William Hitz Mussey,	E.E.,	Washington, D. C.
John Henry Myers,	C.E.,	Lewistown.
John Buckley McBride,	C.E.,	Deckertown, N. J.
*Burt Melville McDonald,	C.E.,	Springfield, Mass.
Franklin Oberly,	E.E.,	Bethlehem.
Louis Atwell Olney,	A.C.,	Providence, R. I.
Horace Lucius Palmer,	C.E.,	Frenchtown, N. J.
*Harry Richards Peck,	M.E.,	Scranton.
*Jacob Grafius Petrikin,	Arch.,	Lock Haven.
*Morris Wright Pool,	M.E.,	Washington, D. C.
*Godwin Hall Powell,	E.M.,	Llanidloes, Wales.
James Lee Rankin, jr.,	M.E.,	Savannah, Ga.
Henry Paul Reed,	E.E.,	New London, Conn.
Homer Austin Reid,	C.E.,	Warren, O.

*Not clear of conditions.

	Course.	Residence.
†Antonio M. Ros-y-Jané,	M.E.,	Guantanamo, Cuba.
*George Homer Ruggles,	C.E.,	Cherokee, Iowa.
*John Cornelius Sesser,	C.E.,	Saint Joseph, Mich.
Arthur Yeager Shepherd,	M.E.,	Wilkes-Barre.
*Luther D. Showalter,	C.E.,	Pottstown.
Henry Shriver, jr.,	M.E.,	Cumberland, Md.
*Harvey Wilson Sprague,	M.E.,	Bethlehem.
Ambrose B. Strickler,	M.E.,	Waynesboro.
Edward Ernest Taylor,	M.E.,	Fort Wayne, Ind.
William Bailey Taylor,	E.E.,	Bethlehem.
John Augustus Thomson,	E.M.,	Summit Point, W.Va.
Edward Coppée Thurston,	E.M.,	South Bethlehem.
Joseph Wharton Thurston,	Clas.,	South Bethlehem.
Curtis Edward Trafton,	E.E.,	Fall River, Mass.
Harry Conklin Tripp,	M.E.,	Millerton, N. Y.
†Charles Parker Wagoner,	C.E.,	Phœnixville.
John Scofield Wallace,	E.M.,	New Castle.
U. Grant S. Walters,	C.E.,	Pottstown.
*John Eugene Weideman,	E.E.,	Washington, D. C.
William Gwilym Whildin,	E.M.,	Lansford.
Davis S. Williams,	Arch.,	Fort Snelling, Minn.
David William Wilson, jr.,	Arch.,	Brooklyn, N. Y.
*Jay Roberts Wilson,	E.E.,	Bethlehem.
Alfred Mahlon Worstall,	E.E.,	Millville, N. J.
*Frank S. Young,	E.M.,	Plymouth Meeting.

SOPHOMORE CLASS.

	Course.	Residence.
*Juan de Dios Amador,	E.E.,	Panama, Rep. Col.
Francis DuPont Ammen,	M.E.,	Ammendale, Md.
Henry Jonathan Biddle Baird,	E.M.,	West Chester.
Lathrop Hutchings Baldwin,	M.E.,	Allentown.
Charles Herbert Barker,	C.E.,	Morant Bay, Jamaica.

*Not clear of conditions.
†Excused.

	Course.	Residence.
Charles Marshall Barton,	C.E.,	Pikesville, Md.
Frank Breckenridge Bell,	M.E.,	Mercer.
Harry Layfield Bell,	E.E.,	Norfolk, Va.
William Ragan Binkley,	E.E.,	Hagerstown, Md.
Francis Jos. Blickensderfer,	E.E.,	Bethlehem.
Bertine Frederick Borhek,	A.C.,	Bethlehem.
Charles Schwartze Bowers,	E.E.,	Philadelphia.
*Frank Austin Boyer,	E.M.,	Pine Grove.
John Boyt,	E.M.,	Adamsford.
William Burke Brady,	M.E.,	Harrisburg.
Daniel John Broughal,	A.C.,	South Bethlehem.
*Horatio Francis Brown,	M.E.,	Baltimore, Md.
Walter Everette Brown,	E.E.,	Stamford, Conn.
*Robert Berdell Cable, jr.,	M.E.,	Bethlehem.
*David J. Castilla,	M.E.,	Coahuila, Mex.
*Amado Cavazos,	E.M.,	Saltillo, Mex.
Sinclair Wiggins Chiles,	C.E.,	Sims City, Fla.
Thomas Holland Clagett,	E.M.,	Berryville, Va.
*Thomas Micks Clinton,	E.E.,	Baltimore, Md.
Barton Olmsted Curtis,	C.E.,	Iowa City, Iowa.
*Patrick Edward Dinan,	A.C.,	South Bethlehem.
Louis Diven,	E.E.,	Elmira, N. Y.
William Kuhn Dunbar,	C.E.,	Pittsburg.
*Clifford George Dunnells,	E.E.,	Pittsburg.
Stuart Rhett Elliott,	E.M.,	Beaufort, S. C.
*John Augustus Fisher,	E.M.,	Huntingdon.
Ira D. Fulmer,	E.E.,	Richland Centre.
Francis Martinez Gallardo,	M.E.,	Guadalajara, Mex.
Orrin Satterlee Good,	E.E.,	Lock Haven.
Ralph Scofield Griswold,	E.E.,	Madison, N. J.
John Lewis Gross,	M.E.,	Wilkes-Barre.
†Frank Hammond Gunsolus,	Arch.,	Tipton, Iowa.
Hugh Ellmaker Hale,	C.E.,	Philipsburg.
*Charles Edwin Hammond,	C.E.,	Geneva, N. Y.
William Thomas Hanly,	C.E.,	Philadelphia.
Erle Reiter Hannum,	E.E.,	Pottsville.

*Not clear of conditions.

	Course.	Residence.
Albert Wilfred Harned,	M.E.,	Philadelphia.
William Stephen Hiester,	E.E.,	Elmira, N. Y.
Ross Nathaniel Hood,	E.E.,	Duncannon.
Henry Taylor Irwin,	M.E.,	Allegheny.
James Madison Jackson,	M.E.,	Parkersburg, W. Va.
*Philip H. Janney,	M.E.,	Baltimore, Md.
Arthur Perkins Jenks,	E.E.,	Philadelphia.
Harry Sackett Johnson,	E.E.,	East Aurora, N. Y.
Duncan Kennedy, jr.,	E.E.,	Newport, R. I.
Lawrence Rust Lee,	M.E.,	Shepherdstown, W.Va
Ernest Tisdel Lefevre,	E.M.,	Panama, Rep. Col.
†Charles Victor Livingstone,	E.E.,	Kingston, N. Y.
Arthur Frost Loomis,	E.E.,	Oneida, N. Y.
Owen Gray MacKnight,	E.E.,	Plains.
Barry MacNutt,	E.E.,	Bethlehem.
*Lee Holmes Marshall,	M.E.,	Pittsburg.
William A. Megraw,	M.E.,	Baltimore, Md.
*Esteban Angel Mercenario,	C.E.,	Puebla, Mex.
Thaddeus Merriman,	C.E.,	South Bethlehem.
Frank Douglass Mount,	C.E.,	Manasquan, N. J.
Carl Pivany Nachod,	E.E.,	Philadelphia.
*Charles G. Newton,	E.M.,	Guadalajara, Mexico.
*Henry H. Newton,	M.E.,	Guadalajara, Mexico.
Robert Collyer Noerr,	C.E.,	Washington, D. C.
Charles Carroll O'Donnell,	C.E.,	Connellsville.
John O'Reilly,	A.C.,	Philadelphia.
James Harkins Pennington,	M.E.,	Yerkes.
William Lindley Pettit, jr.,	C.E.,	Fort Wayne, Ind.
†Edward Arlington Pittis,	C.E.,	Washington, D. C.
*Samuel Jackson Randall,	Sci.,	South Bethlehem.
John Peake Reynolds, jr.,	M.E.,	Charleston, S. C.
Samuel Stewart Riegel,	M.E.,	South Bethlehem.
Eugene P. Roundey,	C.E.,	East Orange, N. J.
Woodford Royce,	M.E.,	Willimantic, Conn.
Auguste Leopold Saltzman,	M.E.,	Plainfield, N. J.
*Charles Fred. Sanders,	C.E.,	Kutztown.

* Not clear of conditions.
† Excused.

	Course.	Residence.
*Charles Francis Scott,	E.E.,	New York City.
Henry Hamilton Seabrook,	E.E.,	Beaufort, S. C.
Joseph Israel Seigfried,	A.C.,	South Bethlehem.
Samuel Palmer Senior,	C.E.,	Washington, D. C.
Arthur Harold Serrell,	E.E.,	Plainfield, N. J.
Frank Bradley Sheaffer,	C.E.,	New Bethlehem.
John Leefe Sheppard, jr.,	M.E.,	Charleston, S. C.
Edward Peter Shuman,	C.E.,	Allentown.
Joseph Henry Siegel,	E.M.,	Salt Lake City, Utah.
Jonathan Edward Slade,	C.E.,	Chicago, Ill.
*Michael T. Eagan Stack,	C.E.,	Shenandoah.
Alvin Riegel Sterner,	E.E.,	Bethlehem.
John Stewart, jr.,	E.M.,	Lonaconing, Md.
Paul Beno Straub,	E.E.,	Pittsburg.
*John Williams Thomas,	E.E.,	Hokendauqua.
Thomas Cedwyn Thomas,	E.M.,	Wilkes-Barre.
Columbus William Thorn,	C.E.,	Washington, D. C.
William Tidball,	E.E.,	New York City.
Wallace Treichler,	C.E.,	Elizabethtown.
Harry Carpenter Tschudy,	C.E.,	Smyrna, Del.
William Edward Underwood,	M.E.,	Lancaster.
Harrison Ricord Van Duyne,	E.E.,	Newark, N. J.
*James F. Wallace,	A.C.,	New Castle.
Edward Hileman Waring,	M.E.,	Plainfield, N. J.
*Clarence Earl Weaver,	E.E.,	Bradford.
Gilbert Case White,	C.E.,	Richmond, Va.
I. H. Wiesenberg,	A.C.,	South Bethlehem.
*William Bell Wood,	M.E.,	Baltimore, Md.
Warren Worthington,	E.E.,	Rush Valley.
George Livingston Yates,	E.E.,	Carlisle.
Ambrose Everett Yohn,	M.E.,	Saxton.

*Not clear of conditions.

FRESHMAN CLASS.

	Course.	Residence.
Harry Leigh Adams,	C.E.,	Washington, D. C.
†Llewellyn Allport,	C.E.,	Philipsburg.
Thomas Johns Anderson,	M.E.,	Cumberland, Md.
William Ernst Arrison,	E.E.,	Philadelphia.
Alanson Quigley Bailey,	Clas.,	Paterson, N. J.
*Clarence Barnard,	E.E.,	Washington, D. C.
*Alejandro Barrientos,	C.E.,	Santiago de Cuba.
Carlos Hernaiz Becerra,	E.M.,	Bogota, Rep. Col.
Richard Becerra, jr.,	A.C.,	Bogota, Rep. Col.
Arthur K. Birch,	E.E.,	Washington, D. C.
Henry David Bishop,	M.E.,	Bethlehem.
Henry Theodore Borhek,	E.M.,	Bethlehem.
Ralph Raymond Bowdle,	C.E.,	Bethlehem.
Paul Bucher,	E.E.,	Lebanon.
*Mahlon Brown Buckman,	E.E.,	Philadelphia.
John W. Burrows,	E.E.,	Sewickley.
Robert William Canning,	E.E.,	South Bethlehem.
†Greenleaf Howe Chasmar,	E.E.,	Brooklyn, N. Y.
David Hope Childs,	E.M.,	Towanda.
Richard Francis Cleary,	E.E.,	Mahanoy City.
Benjamin Cooper Corbett,	M.E.,	New York City.
Herbert Myron Daggett,	E.E.,	Elmira, N. Y.
*Frank Foster Daves,	M.E.,	Baltimore, Md.
William Adam Dehm,	C.E.,	New Britain, Conn.
Willis Edward Diehl,	C.E.,	Bethlehem.
*Neale Edward Donnellon,	A.C.,	Brooklyn, N. Y.
*Lewis Rutter Downing,	C.E.,	East Downingtown.
John Jacob Eckfeldt,	M.E.,	Conshohocken.
Linden Erle Edgar,	M.E.,	Wilkes-Barre.
Edgar D. Edmonston,	E.E.,	Washington, D. C.
James Chickering England,	E.E.,	Washington, N. J.
Roy Lyman Evans,	C.E.,	Bethlehem.
James Ralph Farwell,	M.E.,	Oswego, N. Y.
*Herbert William Fitzgerald,	E.E.,	Columbia.

* Not clear of conditions.
† Excused.

	Course.	Residence.
Theodore Frederick Forbes,	E.E.,	St. Augustine, Fla.
Grier Foresman,	A.C.,	Williamsport.
*Peirce Currier Foster,	E.E.,	Washington, D. C.
*Edmund William Fothergill,	M.E.,	Fall River, Mass.
Willard Boyer Fuller,	M.E.,	Catasauqua.
†Archibald S. Furtwangler,	E.M.,	Greensburg.
José Maria Garza Galan,	E.M.,	Saltillo, Mex.
J. Walter Gannon,	C.E.,	New Brighton, N. Y.
Manuel Garcia,	E.E.,	Porto Rico.
*Stuart John Gass,	E.E.,	Washington, D. C.
Robert Edward Lee George,	E.E.,	Ellicott City, Md.
Charles Gore.	E.M.,	St. George, Md.
William Gratz,	E.E.,	Carmel, N. J.
William Gummere,	A.C.,	South Bethlehem.
Wentworth Greene Hare.	M.E.,	Philadelphia.
Bolling Haxall Harrison,	E.M.,	Baltimore, Md.
*John Dwight Hastings,	E.E.,	Christiana.
Raymond Hazel,	E.E.,	Cressona.
†George Duncan Heisey.	E.M.,	Pittsburg.
Henry Bruner Hershey,	E.E.,	Columbia.
Herbert H. Hess,	E.E.,	Hellertown.
Edward D. Hillman,	M.E.,	Wilkes-Barre.
Harold John Horn,	E.E.,	South Bethlehem.
Leonard S. Horner,	E.E.,	Marshall, Va.
James Cuthbert Holderness,	E.E.,	Cambridge, Mass.
Harry Reese James,	M.E.,	Braddock.
Spencer Jackson Johnson,	E.M.,	Chicago, Ill.
Edwin H. Kiehl,	C.E.,	Lancaster.
Wilmot Henry Kissam,	C.E.,	Huntington, N. Y.
Frank Norman Kneas,	C.E.,	Norristown.
Arthur Octavius Knight,	E.E.,	Washington, D. C.
†Edward Steckel Knisely,	M.E.,	Bethlehem.
Basil George Kodjbanoff,	E.E.,	Monastir, Macedonia.
Lewis Daniel Kreidler,	A.C.,	Bath.
*L. H. Kunkle,	M.E.,	Greensburg.
Thomas H. Lawrence,	E.E.,	Danville.

*Not clear of conditions.
†Excused.

	Course.	Residence.
George Craig Leidy,	E.E.,	Washington, D. C.
Newton Wambold Leidy,	E.E.,	West Bethlehem.
Joseph William Linton,	E.E.,	Bethlehem.
Clarence Albert Loomis,	C.E.,	Bethlehem.
Ralston Rife Lukens,	C.E.,	Atglen.
Frederic Kennedy Lundy,	E.E.,	Williamsport.
Robert Lazarus Martz,	Arch.,	Allentown.
George Beaver Mauser,	A.C.,	Treichlers.
C. Lyman Meixel,	E.E.,	Hummelstown.
Sidney Burbank Merrill,	A.C.,	Newport, Ky.
Erwin Preston Miller,	L.S.,	Bethlehem.
Charles Francis Moritz,	E.E.,	South Bethlehem.
Frank Jacob Myers,	E.M.,	Bethlehem.
George K. McGunnegle,	A.C.,	Meadville.
Marion Arminius Nagle,	M.E.,	Elmira, N. Y.
Edward Jay Newbaker,	E.M.,	Danville.
José Aristides de Obaldia,	C.E.,	Panama, Rep. Col.
Howard Charles Paddock,	C.E.,	East Berlin, Conn.
Henry Ralph Palmer,	E.E.,	West Chester.
Frederick Allen Perley,	C.E.,	Williamsport.
Clarence Marion Pflueger,	A.C.,	Seidersville.
*Victor Clinton Records,	C.E.,	Laurel, Del.
Percy Lawrence Reed,	C.E.,	New Bedford, Mass.
Benjamin DeWitt Riegel,	M.E.,	Riegelsville, N. J.
Howard Albert Riegel,	C.E.,	Bethlehem.
George Milton Robinson, jr.,	E.E.,	Elmira, N. Y.
Carl John Roelker,	E.E.,	Washington, D. C.
D'Arcy Wentworth Roper,	M.E.,	Petersburg, Va.
Wallace Edgar Ruhe,	E.E.,	Allentown.
Rafael Francisco Sanchez,	E.M.,	Matanzas, Cuba.
*Arthur Percy de Saulles,	M.E.,	South Bethlehem.
Frank Ezekiel Schneller,	A.C.,	Bethlehem.
Henry Harger Scovil,	M.E.,	Copenhagen, N. Y.
Frank H. Shenck,	M.E.,	Salunga.
Daniel Franklin B. Shepp,	C.E.,	Tamaqua.
Louis Soleliac, jr.,	E.E.,	Allentown.

* Not clear of conditions.

	Course.	Residence.
Lewis Cheston Starkey,	M.E.,	Bustleton.
James Willis Stauffer,	Arch.,	South Bethlehem.
Robert Witmer Sterrett,	E.E.,	Milroy.
Martin S. Stockett,	Clas.,	Pottsville.
Edmund Harrison Symington,	M.E.,	Baltimore, Md.
John Tenney, jr.,	C.E.,	Philadelphia.
Harry Wellington Thatcher,	A.C.,	South Bethlehem.
William Wharton Thurston,	E.M.,	South Bethlehem.
Richard Albert Turner,	C.E.,	Willimantic, Conn.
William F. Ulrich,	A.C.,	Bethlehem.
*Laurens Van Benthem van den Bergh,	E.E.,	Arnhem, Holland.
Charles Bartlett Warren,	M.E.,	Westfield, Mass.
Levi Watts,	E.E.,	Terre Hill.
Charles Edward Webster, jr.,	Clas.,	South Bethlehem.
David Sheibley Wert,	E.E.,	Carlisle.
Frederick Charles Wettlaufer,	A.C.,	Hoboken, N. J.
Howard Josephus Wiegner,	Arch.,	Bethlehem.
Harry Packer Wilbur,	A.C.,	South Bethlehem.
Theodore Benjamin Wood, jr.,	M.E.,	Chambersburg.
Lawrence Wooden,	A.C.,	Hampstead, Md.
Samuel A. Yorks,	E.E.,	Danville.
Harry Statten Zimmerman,	C.E.,	State Line.

SPECIAL STUDENTS.

	Course.	Residence.
Chauncey Matlock,	E.E.,	Brooklyn, N. Y.
Gwynne Harris Sharrer,	E.M.,	Washington, D. C.
Frank Betts Smith,	M.E.,	Hartford, Conn.
Ignacio Maria Zertuche,	E.M.,	Matehuala, Mex.

*Not clear of conditions.

SUMMARY OF STUDENTS BY STATES.

Vermont,	1
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Connecticut,	11
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Maryland,	35
District of Columbia,	25
Virginia,	8
West Virginia,	4
North Carolina,	1
South Carolina,	5
Georgia,	2
Florida,	2
Mississippi,	2
Kentucky,	3
Tennessee,	3
Missouri,	2
Ohio,	3
Indiana,	3
Illinois,	5
Michigan,	1
Minnesota,	3
Iowa,	4

Kansas,	1
Utah,	1
Indian Territory,	2
Nova Scotia,	1
Mexico,	10
Cuba,	4
Jamaica,	3
Porto Rico,	1
Costa Rica,	1
Republic of Colombia,	5
Wales,	1
Holland,	2
Macedonia,	1
	499

SUMMARY OF STUDENTS BY CLASSES AND COURSES.

	Graduates.	Seniors.	Juniors.	Sophomores.	Freshmen.	Specials.	Totals.
Classical,	4	6	3	—	3	—	16
Latin-Scientific,	—	1	—	—	1	—	2
Science and Letters,	—	4	1	1	—	—	6
Civil Engineering,	3	40	35	26	24	—	128
Mechanical Eng.,	2	20	25	27	24	1	99
Mining Eng.,	6	14	11	12	13	2	58
Electrical Eng.,	2	27	27	33	46	1	136
Analytical Chem.,	3	12	5	7	14	—	41
Architecture,	1	3	5	1	3	—	13
Totals,	21	127	112	107	128	4	499

THE LEHIGH UNIVERSITY.

ORIGIN.

The Hon. Asa Packer, of Mauch Chunk, during the year 1865, appropriated the sum of $500,000, to which he added one hundred and fifteen acres of land in South Bethlehem, to establish an educational institution in the rich and beautiful Valley of the Lehigh. From this foundation rose The Lehigh University, incorporated by the Legislature of Pennsylvania in 1866. In addition to these gifts, made during his lifetime, Judge Packer by his last will secured to the University an endowment of $1,500,000, and to the University Library one of $500,000.

DESIGN.

The original object of Judge Packer was to afford the young men of the Lehigh Valley a complete education, technical, literary, and scientific, for those professions represented in the development of the peculiar resources of the surrounding region. In furtherance of this purpose instruction is liberally provided in Civil, Mechanical, Mining, and Electrical Engineering, Chemistry, Metallurgy, Architecture, and in all needful collateral studies. A School of General Literature is also established and thoroughly equipped, with three departments, called respectively the Classical, the Latin-Scientific, and that of Science and Letters. These departments are kept up to the standard, and the requirements for entrance are the same as those of our best Classical and Literary institutions.

TUITION.

The following charges are made for tuition:

For students in the Technical courses, $100 per annum: $40 for the first term, $60 for the second term; for stu-

dents in the school of General Literature, $60 per annum: $25 for the first term, $35 for the second term.

These fees include all tuition, with the use of the Library and Gymnasium, but the student is charged for materials and apparatus consumed in the Laboratories.

The Trustees have placed at the disposal of the Faculty a limited number of scholarships, to be awarded to applicants of good moral character who shall pass the entrance examinations creditably, and who for other cause shall be regarded as worthy by the Faculty.

Applications for these free scholarships should be made, not less than one week before the opening of the term, to the President of the University, who will furnish all needed information concerning the regulations which govern their bestowal.

All fees for tuition are payable to the Treasurer of the University in two instalments, as above. The first instalment is to be paid to the treasurer of the University on or before October 10; the second on or before January 20.

Students who fail to pay tuition fees when due will be notified by the President that their attendance at college exercises must be discontinued until payment is made.

Every candidate for a degree is required to pay a graduation fee of $10, when the degree is awarded.

PUBLIC WORSHIP.

Prayers are held in the Packer Memorial Church of the University every morning and all students are required to be present.

Divine service is held every Sunday morning in the church. The service is according to the forms of the Protestant Episcopal Church, under whose auspices the University was placed by its Founder. Attendance is required of every student, except in case of those connected with other religious bodies, to whom the President will grant permission at the beginning of each term (if requested

by the parent or guardian, or by the student himself if he be 21 years of age) to attend during that term the place of worship of the body with which he is connected, where attendance on Sunday morning will be required.

SITE.

The situation of the institution is healthful and beautiful. The region is famous for its railway and manufacturing enterprises; it possesses some of the richest iron and coal mines in our land, and thus gives the students rare facilities for confirming the teachings of the recitation room by the observation of the eye.

The University buildings are about a half-mile from the depot, at the junction of the Lehigh Valley and North Pennsylvania Railroads. New York is ninety-two and Philadelphia fifty-seven miles distant.

BUILDINGS.

PACKER HALL,

named after the Founder, stands seven hundred feet back of Packer Avenue, at the base of the South Mountain. It is built of stone, and contains lecture and recitation rooms, the drawing rooms, and the museum of geology and natural history.

THE CHEMICAL LABORATORY

is thoroughly fire-proof, is built of sandstone, and is 219 feet in length by 44 in width.

There are two principal stories and a basement. The upper floor is occupied by the quantitative and the qualitative chemical laboratories, the former accommodating 48 and the latter 84 students. These rooms are 22 feet in height, and are well lighted and ventilated. A laboratory for industrial chemistry and the supply room are also on this floor.

The first floor contains a large lecture room, a recitation room, a chemical museum, and laboratories for organic, physiological, agricultural, and sanitary chemistry.

In the basement is the large laboratory for the furnace assay of ores and a well appointed laboratory for gas analysis, also rooms containing the apparatus for several processes in industrial chemistry, the engine and air-pump for vacuum filtration, a store room, and the toilet.

A photographic laboratory is located in the third story of the central portion of the building.

THE METALLURGICAL LABORATORY

contains a lecture room, a blowpipe laboratory for class instruction in blowpipe analysis and in the practical determination of crystals and minerals, a museum for mineralogical and metallurgical collections, a mineralogical laboratory provided with a Fuess reflecting goniometer, a polariscope, a Groth's "universal apparat," and a Rosenbusch polarizing microscope, a dry laboratory provided with furnaces for solid fuel and for gas with natural draught and with blast, and a wet laboratory for ordinary analytical work. It is arranged for the instruction of classes in the courses of mineralogy, metallurgy, and blowpipe analysis of the regular curriculum, and to afford facilities to a limited number of advanced students for familiarizing themselves with the methods of measurement and research employed in mineralogy and metallurgy, and for conducting original investigations in these departments of science.

THE NEW PHYSICAL LABORATORY.

This building has been finished and is now in use. It is of stone, 235 feet in length, and 4 stories in height. The first or ground floor is devoted to electrical work, and forms the Senior Electrical Laboratory. It contains a large dynamo room, with the engine, dynamos, and motors, with all their appliances; battery, balance, calorimetric rooms and workshops. The eastern part of this story has been carefully arranged for delicate work. The use of iron has been avoided; the gas and steam mains and pipes, radiators, etc., are all of brass. In this section are seven special rooms for investigations of the magnetic properties of iron and

original research. A hall over 200 feet in length can be darkened and utilized for long range work in testing lamps. Under this floor is the "cave" or even-temperature room, completely enclosed with solid stone masonry. On this and the other three floors are private laboratories, store and apparatus rooms, and offices for instructors.

The second story contains the Junior Electrical Laboratory, 56 by 44 feet; the Mechanical Laboratory, 60 by 44 feet, with tables for 80 students, the Library, a time and two balance rooms, with floors resting on solid stone arches.

On the third floor is a public hall, 70 by 44 feet, for examinations: also the professor's lecture room, 40 by 44 feet, with private laboratories, etc.

On the fourth floor in the west wing are two recitation rooms for the instructors, 40 by 18 feet, and the Heat Laboratory, 44 feet square, with tables for 72 persons. On the east side is the Light Laboratory. This contains one room with tables for 40 persons, and 8 smaller dark rooms, each of which can be divided into two parts. Besides these are 4 photographic dark rooms, 8 by 28 feet feet, each with all the necessary equipments.

The tower, which is devoted to meteorological purposes, has two stories of one room each, 16 by 21 feet, with a vane room above. Besides these there are several small rooms for special purposes scattered among the four floors.

The tendency in the latest and best Physical Laboratories is towards a larger number of smaller rooms, rather than to a few large rooms. It will be seen from this description that the advantages of this plan have been gained by the many smaller rooms that exist, while for general work the larger halls are provided.

Three staircases at the middle and the two ends of the building afford ample means of entrance and egress.

THE SAYRE OBSERVATORY.

Near Brodhead Avenue is the Sayre Observatory, the gift of Robert H. Sayre, Esq., of South Bethlehem, containing an equatorial and a zenith telescope, transit instrument, and astronomical clock.

THE PACKER MEMORIAL CHURCH

is the munificent gift of Mrs. Mary Packer Cummings, daughter of the Founder of the University. It is a large and magnificent Church, richly furnished and handsomely appointed in every particular. There is no more beautiful Church edifice in the State and it is one of the noblest in all the land.

THE UNIVERSITY LIBRARY.

To the east of Packer Hall is the University Library, erected by the Founder in memory of Mrs. Lucy Packer Linderman, his daughter.

THE GYMNASIUM

is a handsome and spacious structure, built and equipped with the utmost thoroughness. It is furnished with the best patterns of gymnastic apparatus, besides Dr. Sargent's system of developing appliances. It is provided with hot and cold water; tub, sponge, and shower baths, and 389 clothes closets. Opportunities for recreation and amusement are provided in the bowling alleys. It is under the immediate care of a skilled and competent Director.

All students are required to undergo a physical examination before being allowed the use of the Gymnasium, and this examination will be repeated once each year during their stay at the University. The proper exercise is prescribed and is required of every student. These regulations are designed to promote the harmonious, symmetrical development of the individual student.

EXPENSES.

Books, materials, paper, pencils, materials used in the chemical laboratories, and drawing instruments are furnished by the student. Materials consumed in the chemical laboratories can be obtained from the University, their value being covered by a deposit made at the opening of that term in which the laboratory work is to be done.

Rooms and board can not be had in University buildings, but can readily be obtained in many private houses.

The following is an estimate of the necessary expenses for the collegiate year, clothing and traveling not included :

Tuition, ...	$100	$100
Board for 40 weeks, . . . from	160 to	200
Room-rent, with fuel and lights .	40 "	80
Care of room and use of furniture, .	5 "	20
Washing and incidentals, . . .	20 "	40
Books, stationery, etc., . . .	25 "	50
Total, ...	$350 to	$490

(In the case of students in the School of General Literature, the totals will be $310 to $450.)

NOTE.—If clubs be formed the cost of board need not exceed $3.50 per week.

ADMISSION OF STUDENTS.

The Register is intended to give all necessary information concerning the admission of students. Application may be made to the President of the University if information is desired which is not given in the Register.

DATE OF EXAMINATIONS

Examinations for admission to the University are held at the opening of each term, and also in June at the close of the academic year.

The examinations for 1895 will be on Tuesday and Wednesday, January 8 and 9, for admission to the second term; on Thursday, Friday, and Saturday, June 20, 21, and 22, and on Saturday, Monday, and Tuesday, September 7, 9, and 10, for admission to the first term. No other examinations for entrance will be held, except for good cause, and all applicants *must* be in attendance at 9 o'clock on the morning of the first day.

The examinations are held in June and September in the following order:

First Day.—English, 9 A.M.; Arithmetic, 11 A.M.; Physics, 2 P.M.; Latin and Roman History, 2 P.M.

Second Day.—Geometry, 8.30 A.M.; Physical Geography, 11.30 A.M.; Geography, 3 P.M.; United States History, 4 P.M.

Third Day.—Algebra, 8.30 A.M.; Greek and Greek History, 2 P.M.

Applicants for entrance who wish to present certificates from preparatory schools as an equivalent for the examinations in English, Geography, and U. S. History are required to hand them to the examiner at 8.15 on the morning of the first day.

The schedules of examinations for applicants for admission to the Freshman Class at the beginning of the second term and to the Sophomore Class at the beginning of the first term may be obtained from the Secretary of the Faculty. Examinations at other than the appointed times can not be granted without great inconvenience, and candidates so applying will be required to pay a fee of $5 into the Faculty's fund for the aid of indigent students.

CHARACTER OF THE EXAMINATIONS.

The examinations are rigorous and cover the entire ground laid down in the following scheme. They are all conducted in writing, supplemented by an oral examination at the option of the examiner.

Each candidate for admission must be at least sixteen years of age, and must present a testimonial of good moral character from his last instructor, or from the school or institute to which he last belonged, or from some reputable citizen of the community in which he lives.

Candidates for admission to

THE CLASSICAL COURSE

are examined in the following subjects:

1. *English.*—This requirement includes: (*a*) English Grammar, especial attention being given to the analysis and correction of sentences; and (*b*) Rhetoric and Composition. Any High School Rhetoric, such as Hart, Hill, Williams, Kellogg, and others of a like grade, will be sufficient, together with practical exercises in composition. Candidates are required to write a composition of four hundred words upon a subject announced at the time. The subject in 1895 will be taken from one of the following works: Longfellow's Evangeline, Scott's Kenilworth, Dickens's Nicholas Nickleby, Gray's Elegy in a Country Churchyard. In 1896, a subject will be taken from one of the following: Scott's Lady of the Lake, Dickens's David Copperfield, Irving's Sketch Book, Hawthorne's Marble Faun.

2. *Geography*, general and political.

3. *History of the United States*, including the *Constitution.*

4. *Arithmetic*, including the metric system of weights and measures.

5. *Algebra.*—Fundamental principles. Factoring. Least common multiple. Greatest common divisor. Fractions. Involution. Evolution. Radicals. Imaginary quantities. Equations of the first and second degrees. Ratio. Proportion and progressions.

[Olney's University Algebra or Meaker's Elements of Algebra is recommended for preparation.]

6. *Geometry.*—Fundamental principles. Rectilinear figures. The circle. Proportional lines and similar figures. Comparison and measurement of the surfaces of rectilinear figures.

[Chauvenet's Geometry (four books) is recommended, that being the text-book used in the University.]

7. *Physical Geography.*

8. *Latin Grammar.*

9. *Cæsar*, four books of the Gallic war.

10. *Cicero*, six orations, including the four against Catiline.

11. *Vergil*, the first six books of the Æneid, including Prosody.

12. The translation, at sight, of passages from Cæsar and Cicero.

13. The translation of English into Latin. (As special importance is given this part of the examination, it is suggested to teachers that they connect exercises in making Latin, both oral and written, with all the studies of the preparatory course.)

14. *Roman History.*—Creighton, Pennell, or Myers.

15. *Greek Grammar.*

16. *Xenophon*, Anabasis, four books.

17. *Homer*, Iliad, first three books, including Prosody The Catalogue of Ships may be omitted.

18. The translation, at sight, of a passage from some work of Xenophon.

19. *Greek History.*—Fyffe, Pennell, or Myers (pp. 152–357).

20. Writing Greek with accents.

The pronunciation of Greek according to the written accents is followed in the University, and it is desirable that students preparing to enter be taught this system.

Latin is pronounced according to the method generally known as the Roman Method.

THE LATIN-SCIENTIFIC COURSE.

Candidates for admission to this course must present the first fourteen of the above requirements, but substitute for the Greek sections (numbers 15–20 inclusive) the following:

21. *Geometry.*—Regular polygons. Measurement of the circle. Maxima and minima of plane figures, and plane and polyhedral angles: these constituting the subject matter of Books Five and Six of Chauvenet's Geometry.

THE COURSE IN SCIENCE AND LETTERS.

Candidates for admission to this course are examined in all the subjects demanded of those entering the Latin-Scientific Course, except the Latin and Physical Geography sections (numbers 7–14 inclusive). They also present the following:

22. *Elementary Physics.*

[Avery's Elements of Natural Philosophy (revised edition) is recommended; also Gage's Elements of Physics, if studied as intended by the author, with practical work in the laboratory by the student and the calculation of problems arising in the work.]

THE SCHOOL OF TECHNOLOGY.

Candidates for admission to the Courses in Civil Engineering, Mechanical Engineering, Mining Engineering, Electrical Engineering, Chemistry, and Architecture are examined in the following subjects:

1. *English.*—This requirement includes: (*a*) English Grammar, especial attention being given to the analysis and correction of sentences; and (*b*) Rhetoric and Composition. Any High School Rhetoric, such as Hart, Hill, Williams, Kellogg, and others of a like grade, will be sufficient, together with practical exercises in composition. Candidates are required to write a composition of four hundred words upon a subject to be announced at the time. The subject in 1895 will be taken from one of the following works: Longfellow's Evangeline, Scott's Kenilworth, Dickens's Nicholas Nickleby, Gray's Elegy in a Country Churchyard. In 1896 a subject will be taken from one of the following: Scott's Lady of the Lake, Dickens's David Copperfield, Irving's Sketch-Book, Hawthorne's Marble Faun. It is recommended that candidates have a knowledge of Latin Grammar, although an examination in it is not required for any courses except the Classical and the Latin-Scientific.

2. *Geography*, general and political.

3. *History of the United States*, including the *Constitution.*

4. *Arithmetic*, including the metric system of weights and measures.

5. *Algebra.*—Fundamental principles. Factoring. Least common multiple. Greatest common divisor. Fractions. Involution. Evolution. Radicals. Imaginary quantities. Equations of the first and second degrees. Ratio. Proportion and progressions.

[Olney's University Algebra or Meaker's Elements of Algebra is recommended for preparation.]

6. *Geometry.*—Fundamental principles. Rectilinear figures. The circle. Proportional lines and similar figures. Comparison and measurement of the surfaces of rectilinear figures. Regular polygons. Measurement of the circle. Maxima and minima of plane figures, and plane and polyhedral angles; these constituting the subject matter of the first six books of Chauvenet's Geometry.

[Chauvenet's Geometry is recommended, that being the text-book used in the University.]

7. *Elementary Physics.*

[Avery's Elements of Natural Philosophy (revised edition) is recommended; also Gage's Elements of Physics, if studied as intended by the author, with practical work in the laboratory and the calculation of problems arising in the work.]

Division of Entrance Examination.

Candidates for admission to the Freshman Class may pass all the examinations in June, or all in September, or partly in June and partly in September, or may take them in *two consecutive years*. In the latter case, for the Technical courses and the course in Science and Letters, candidates may present themselves for examination in the first year in the following subjects: English, Geography, History of the United States, and Arithmetic. No credit will be given unless the candidate has passed satisfactorily in at least three subjects at one examination.

The examinations in Algebra, Geometry, and Physics must be passed in June or September of that year in which the candidate proposes to enter the University.

In the Latin-Scientific and Classical courses candidates may present themselves for examination in the first year in the following subjects: English, Geography, History of the United States, Arithmetic, Physical Geography, Roman History, and Greek History. No credit will be given unless the candidate has passed at least four of the subjects at one examination.

The examination in Latin may also be divided, but no credit will be given unless the candidate has passed in at least three of the topics specified at one examination. The examinations in the remaining subjects must be passed in June or September of that year in which the candidate proposes to enter the University.

Candidates intending to enter the University in September are advised to present themselves for examination in June; if they are not fully prepared at that time they will receive credit for the examinations then satisfactorily passed.

CONDITIONAL ADMISSION.

A candidate failing to pass in one or more of the subjects required for admission may, at the discretion of the Faculty, be admitted to his class conditionally, to make up his deficiencies by extra study. When they are made up, he will be received into full standing in his class.

SPECIAL STUDENTS.

Young men of advanced standing, who do not desire to take a full regular course, can enter and select special shorter courses, with the sanction of the Faculty; but in all cases satisfactory examinations must be passed upon the subjects required for entrance to the Freshman Class.

ADMISSION TO ADVANCED STUDIES.

Candidates for admission to advanced studies *in any course* are required to pass, *in addition to the entrance examinations for that course*, examinations in the work already done by the classes which they desire to enter. These examinations are held on the same days as those for entrance to the Freshman Class.

The additional subjects may be found in the program of studies.

A diploma showing that a degree has been conferred, or a certificate of studies taken at another College will be received, in so far as it covers the subjects required for entrance, in lieu of the *Primary Entrance Examinations only.*

ADMISSION TO THE POST-GRADUATE COURSE.

Students of this University who have taken their *first* degree, and others, on presenting a diploma of an equivalent degree conferred elsewhere, are admitted to advanced studies, according to the plan to be found in the Register under the general subject of Graduate Students.

PREPARATORY SCHOOL CERTIFICATES

are not accepted so as to dispense with the primary entrance examinations.

NOTE.—The acceptance of a certificate as evidence of proficiency in lieu of examination is at the discretion of each Professor as to the subjects in his department.

PROGRAM OF STUDIES.

Showing the number of exercises per week for each subject, and the Text-books used.

The following is presented as the general program of instruction, subject to such modifications from time to time as the Faculty may deem expedient, with the approval of the Trustees.

The names of the text-books studied are generally mentioned. The number of exercises per week in each subject is indicated by the figure in parenthesis immediately following.

Two hours of drawing, three of work in the laboratory, or three of practice in the field, are regarded as equivalent to a recitation or lecture of one hour's duration.

SCHOOL OF GENERAL LITERATURE.

There are three courses in the School of General Literature of the University.

I. The Classical Course includes all that is prescribed in our best institutions for the degree of Bachelor of Arts (B.A.). It covers full instruction in Greek, Latin, English, French and German, Mathematics, Astronomy, Physics, Chemistry, Geology, Physiology, Hygiene, History, Psychology, Ethics, Philosophy, Political Economy, and Constitutional Law.

II. The Latin-Scientific Course differs from the first in omitting Greek, taking in its place an increased amount of the Modern Languages and of Mathematics. Students completing this course receive the degree of Bachelor of Science (B.S.).

III. The Course in Science and Letters, for which the same degree is given as for the last mentioned, contains no Latin or Greek, but furnishes instead extended instruction in French and German, History, General Literature, Mathematics, and General Science.

Instruction in all of these courses is given both by recitations and by lectures.

DESCRIPTION OF THE COURSES.

GREEK.—During the first term of Freshman year the class reads several books of the Odyssey, giving attention to epic forms and syntax, to prosody and scanning, and to Homeric antiquities and mythology. The work of the second term is directed toward a thorough acquaintance with the idiom and vocabulary of Attic prose, as a preparation for rapid reading. The Œconomicus and Symposium of Xenophon and the Crito of Plato are read during the term, with sight readings from the Memorabilia and the Apology; accompanied with discussions of domestic life at Athens. The work of the year includes a thorough review-drill on the principles of Greek accidence and syntax, and exercises in Greek prose composition are required, based, during the second term, on the reading done by the class. Greek history is studied throughout the year, with special reference to the development of political institutions.

The Sophomore class takes up, during the first term, the study of Herodotus and Thucydides. Selections are made from both authors with the purpose of illustrating their best style and at the same time of presenting, from the original sources, the history of certain interesting epochs: the reading from Herodotus, after some drill on the Ionic forms, being in large part at sight. During the second term the class reads one or two plays of Euripides, with attention to the history of Greek tragedy, the life of the author, and the analysis of the drama read. The lyric meters are studied, with the aim of gaining a knowledge

of the rhythmical and metrical principles of Greek poetry. During this term an elective course is offered, the subject being Greek oratory, with the reading of certain orations of Lysias or Demosthenes, or both.

The Junior year is devoted to a further study of the drama, selected plays of Sophocles, Aristophanes, and Æschylus being read during the year. Work is also done in the study of public and private antiquities, partly in lectures by the professor and partly in original investigation on allotted subjects by the students.

During the first term of the Senior year the class reads either selections from Thucydides, or one of the dialogues of Plato. The second term is in part devoted to the reading of selected odes of Pindar, with careful study of the history of Greek lyric poetry and of the life and work of Pindar in particular. The course concludes with a review of the history of Greek literature, intended to summarize and harmonize the fragmentary views of the general subject gained from the study of particular authors and departments of literature.

LATIN.—Much of the training in the Freshman year is devoted to laying a good foundation in Latin grammar and in the translation of English into Latin. The authors studied are used to illustrate both of these, and a large amount is read at sight in order to cultivate quickness and readiness in the student. Roman history is begun, accompanied with full comments and lectures upon points of interest. Collateral reading will also be recommended each year throughout the course. Cicero: De Senectute and De Amicitia or the Philippics, Livy, and the Odes and Epodes or Horace are read this year. With the last named, training is given in Latin meters.

During this and the following year courses of lectures will be given upon Roman antiquities in addition to a text-book. The topography of Rome with its remains, ancient life in its various aspects, and the other departments of archæology will be discussed, illustrated by the new and

extensive set of over 3600 magic lantern slides which have been prepared for this purpose.

The Sophomore year completes the text-book on Roman history. Quintilian (Bk. X) with Crowell's Selections from the Lyric Poets will be read in the first term, and in the second the Agricola and Germania, with selections from the Annals of Tacitus, together with sight reading.

In the Junior year, selected letters of Cicero and Pliny are read, followed by Persius and several plays of Terence and Plautus. The history of Roman literature is entered upon in the second term.

The work in the Senior year opens with Lucretius, accompanied with lectures on Roman philosophy. The course in the second term this year includes the study of ancient Latin, using Allen's Remnants of Early Latin, supplemented by a series of lectures upon Latin grammar and the history of the development of the language, together with several lectures upon the history of classical philology. Characteristic poems by various authors will be read with full comment and training in the discussion of the literary and critical points which come up.

SANSKRIT.—An elementary course in this study, conducted by the Professor of Latin, is offered as an optional during the Senior year.

HEBREW.—An elementary course in Hebrew, conducted by the Chaplain, is offered as an optional study, open to Seniors and Juniors of the whole University.

ENGLISH.—During Freshman and Sophomore years, Rhetoric is studied, both with the aid of a text-book and through practical exercises. Careful training is given in essay writing throughout the course, and orations are written and delivered during Junior and Senior years. Excellence in Oratory is encouraged by the annual contest for the Alumni Prizes, held on the 22d of February and open to the Junior Class in all departments.

The Seniors receive instruction in the principles of versification and in extemporaneous discussion, and are

required to write a critique of some work selected for their examination.

The history of English literature and the philological history of the English language are studied during Junior year. These are supplemented by a series of lectures, extending through the second term, on the relations of literature to history. The course is completed by a series of lectures on English and American literature, delivered during the second term of Senior year.

ANGLO-SAXON.—An optional course in this subject is offered in Senior and Junior years.

MODERN LANGUAGES.—The study of modern languages is obligatory from the first term of the Sophomore year up to the close of the course. The student elects either French or German, or both, if time permits.

French.—The grammar is begun, reading being introduced immediately. The comparative and historical relations of the French to the English, and the connection of both with the Latin are carefully explained. As soon as possible the student is emancipated from the reader and takes up, in a progressive way, the reading of different authors; preference being given to modern writers, because it is considered to be of the highest importance that he acquire the language as it is, as an instrument whereby further knowledge can be obtained.

In the class-room, the language taught is used by the teacher as much as possible, in order that the ear of the pupil may become accustomed to its sound. Dictation is also employed, in order to give training in spelling. The rules of grammar are taught by numerous written exercises. In the second term of the Junior year, compositions in French are required, upon subjects which have been previously explained in French, in order that the student may become acquainted with different expressions and forms of construction. Before entering upon the study of an author's works, his life and literary achievements are discussed in

French, which is translated, if necessary. In the Senior year, twelve lectures are delivered upon the history of French literature. In addition to this, lectures in French upon the most distinguished modern authors are given to advanced students.

A weekly conversation-class affords opportunity for this kind of practice; and in it the events of the day and various historical and literary topics are discussed. Private courses of reading are also suggested to those who desire it.

German.—The German course follows the same plan as that laid down for the French, both as regards the methods employed and the opportunities afforded. The relations of English and German are dwelt upon and also those which connect the two languages with the Indo-European family.

MATHEMATICS.—The mathematical work is carried on during the Freshman and Sophomore years as follows:

Freshman year, first term, Chauvenet's Geometry, four exercises per week.

Second term, Olney's University Algebra; plane and spherical trigonometry, including mensuration and use of logarithmic tables, together five exercises per week throughout the term.

Sophomore year, first term, Olney's General Geometry and Davies' Analytical Geometry, four exercises per week.

Second term, Olney's Differential and Integral Calculus, four exercises per week. This term's work is elective for the Classical Course.

ASTRONOMY.—This study is taken up during the first term of the Senior year, Young's General Astronomy being used as the text-book. There are three exercises a week, and visits to the observatory help to make the work interesting as well as profitable.

CHEMISTRY.—This study includes a complete course of lectures in Freshman year upon general inorganic chemistry, in which the principles of the science are fully covered. These are illustrated by experiments, and are

sufficiently extended to enable a student who desires to pursue the subject further to take analytical chemistry as an elective in the second term of the Sophomore year. The text-book used in connection with the lectures is Remsen's Inorganic Chemistry.

PHYSICS.—This important subject is presented in a course of lectures during the first term of the Sophomore year, three times a week. These are illustrated by means of the very complete apparatus of the physical laboratory. In the course in Science and Letters, the work in this branch is more extended and is identical with that given to the Civil and Mechanical Engineers. It occupies five hours a week in the first term, when heat, magnetism, and electricity are discussed. Throughout the second term, three hours a week are devoted to sound and light.

GEOLOGY.—In the second term of the Senior year, a course of lectures is given in connection with Le Conte's text-book. The general principles of the science are explained, and the theories of the formation and stratification of rocks, the successive periods of the development of the earth's crust, the extinct forms of life and similar questions are treated.

PHYSIOLOGY AND HYGIENE.—These subjects are taught in a course of lectures during the Freshman year.

HISTORY, POLITICAL SCIENCE AND LAW.—The study of history begins with a course in the political antiquities of Greece and Rome. [See the Departments of Greek and Latin.] This is followed by the study of an outline of universal history (with text-book), and this by a fuller study of the political history of recent times, especially of that of England and France. During the first term of Senior year, there is a course of lectures upon the period covered by Gibbon's Decline and Fall of the Roman Empire. This prepares the way for a course of lectures on the philosophy of history, in which it is sought to set forth the scientific methods of the study of history.

The course in history is accompanied and supplemented by courses of lectures on constitutional law with special application to the Constitution of the United States; and also on international law.

Instruction is given by lectures on the elements of political economy. The student is made familiar with the facts, methods, and doctrines of the science, and is encouraged to form and present his own opinions.

LOGIC.—Junior Class, first term, two hours weekly. Textbook, Prof. Jevons' "Lessons in Logic," supplemented by occasional lectures and by references to more extended logical treatises, such as those of J. S. Mill, Sir William Hamilton, Archbishop Thompson, Baynes' Port Royal Logic, etc.

MENTAL AND MORAL PHILOSOPHY. — The work in this department will be conducted chiefly by lectures, interrupted by occasional examinations. The courses at present are the following:

Outlines of Physiological Psychology. — Junior Class, second term. These lectures are founded principally on Wundt's lectures on the same subject, given in the University of Leipzig in the Summer of 1888, Wundt's Grundzüge der Physiologischen Psychologie, James' Psychology, Baldwin's Handbook, Ladd's Elements of Physiological Psychology, Sully's Outlines of Psychology, Carpenter's Mental Physiology, Maudsley's Physiology and Pathology of the Mind, Bain's Mind and Body, etc., with references to the classical works of Lotze, Weber, Fechner, and Helmholtz.

The History of Philosophy. — Senior Class, both terms. First term, Ancient and Medieval Philosophy. Second term, Modern Philosophy. These lectures will include a statement of the conception and problems of philosophy, a brief sketch of the great ethnical religions, and of the history of Oriental philosophy. The philosophy of the Greeks will be treated in detail, with illustrations from the writings of the philosophers.

The history of medieval philosophy will be prefaced by a short description of the philosophical ideas underlying Christianity, and it will contain an account of the more important Church Fathers and Schoolmen.

The history of modern philosophy will begin by tracing the effect on philosophical thought of the ideas contributed by the Renascence and by the Reformation. From Lord Bacon on, a detailed history of the great modern philosophical systems will be given, which will be continued to those of our own times, including Mr. Spencer.

CHRISTIAN EVIDENCES. — Senior Class, second term. Lectures on Christian evidences, which will endeavor to treat of the subject both from the side of natural science and from that of biblical criticism.

No complete course in Ethics has as yet been established, but the history of ethics is included in the history of philosophy.

THE COURSE IN SCIENCE AND LETTERS

substitutes the following for the Latin and Greek:

DRAWING.—In the first term of the Freshman year the student is instructed in elementary projections, shading, and lettering.

ZOÖLOGY AND BIOLOGY.—The study of these subjects covers one year, beginning with the second term of Sophomore year. The work begins with a description of the various animal functions, and is extended to the comparative anatomy and physiology of the organs in typical species. Systematic zoölogy is then completed and followed by practical biology.

CHEMISTRY. — In addition to the course in general chemistry described above, three exercises a week in qualitative analysis are taken in the second term of the Freshman year.

MINERALOGY.—Instruction in mineralogy is given to the students in the Course in Science and Letters throughout

the Junior year. In the first term, they attend a course of lectures on crystallography, followed by a series of practical exercises in the determination of crystalline forms by the aid of models and natural crystals.

In the second term a course on the physical properties of minerals and on descriptive mineralogy, with the use of E. S. Dana's Text-Book of Mineralogy, is followed by practical exercises in the determination of minerals.

GEOLOGY.—The study of lithology is pursued in the first term of the Senior year, with laboratory practice, Williams' Lithology being used as the text-book. During the next term, the course given above is taken with the Classical and Latin-Scientific students.

THE CLASSICAL COURSE.

FRESHMAN CLASS.

FIRST TERM.

Mathematics.—Geometry (Chauvenet). (3) Plane trigonometry. (1)

Chemistry.—Lectures. Remsen's Inorganic Chemistry. (4)

Greek.—Homer: Odyssey. Prosody. (3)

Latin.—Cicero: De Senectute and De Amicitia. Livy begun. Prose composition. (3)

Physiology and Health.—Lectures. (1)

English.—Rhetoric. (1)

Essays.

Gymnasium. (2)

SECOND TERM.

Mathematics.—Olney's University Algebra, Pt. III. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

Greek.—Xenophon: Œconomicus. (3)

Latin.—Livy completed. Horace: Odes and Epodes. Composition and prosody. (4)

History.—History of Greece. (2) History of Rome. (1) Roman antiquities.

English.—Rhetoric. Trench: English, Past and Present. (1)

Essays.

Gymnasium. (2)

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical geometry: Olney's General Geometry. (4)

Physics.—Lectures. (3)

French.—Whitney's Practical French Grammar. Super's French Reader. (2) Or *German.*—Brandt's Grammar. Lodeman's Manual of Exercises. Buchheim's Reader. (2)

Greek.—Herodotus. (3)

Latin.—Horace: Satires and Epistles. Composition. (2)

History.—History of Rome. (1) Antiquities.

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

SECOND TERM.

French.—Grammar and reader (continued). (2) Or *German.*—Grammar, exercises, and reader (continued). (2)

History.—Weber's Outlines of Universal History. (2)

Greek.—Euripides: Medea. (3)

Latin.—Tacitus: Agricola, Germania, and Annals, or Quintilian: Book X. Composition. (3) Antiquities.

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

In addition to the above exercises, four hours per week must be selected from the following elective studies:

Mathematics.—Differential and integral calculus: Olney. (4)

Greek.—Demosthenes: De Corona. (2)

Latin.—Plautus. (2)

French.—Grammar and reader. (2)

German.—Grammar and reader. (2)

Chemistry.—Stoichiometry and qualitative analysis (laboratory). (4)

JUNIOR CLASS.

FIRST TERM.

History.—Wilhelm Müller's Political History of Recent Times, and lectures. (2)

Philosophy.—Jevons's Lessons in Logic. (2)

English.—Coppée's English Literature. (4)

French.—Grammar. George Sand: La Mare au Diable. Dumas: Pauline. (2) Or *German.*—Grammar. Bernhardt's Novelletten-Bibliothek, II. (2)

Greek.—Sophocles: Antigone. Antiquities. (3)

Latin.—Letters of Cicero and Pliny. (3)

Essays and Original Orations.

Gymnasium. (2)

SECOND TERM.

History.—History of England: Hume. (3)

Philosophy.—Lectures on the outlines of physiological psychology. (2) Political economy. (1)

English.—Earle's Philology of the English Tongue. (2)

French.—Vigny: Le Cachet Rouge. Hugo: La Chute. Dictation. (2) Or *German.*—Buchheim's Prose Composition. Riehl: Culturgeschichtliche Novellen. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2)

Greek.—Aristophanes: Clouds. Æschylus: Prometheus. (3)

Latin.—Persius, Plautus, and Terence. History of Roman literature. (3)

Literature and History. (1)

Essays and Original Orations.

Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

International Law.—Lectures: Woolsey. (2)

History.—Decline and Fall of the Roman Empire: Gibbon. (3)

Philosophy.—Lectures on the history of ancient and mediæval philosophy. (2)

Astronomy.—Young's General Astronomy. (3)

French.—Sadler; Readings in Corneille, Racine, Molière, etc., and contemporary authors. Compositions. Lectures on French literature. (2) Or *German.*—Grammar. Readings in Lessing, Herder, Goethe, Schiller, etc., and contemporary authors. Compositions. Lectures on German literature. (2) Conversation class in both languages optional throughout the year.

Greek.—Plato: Phædrus. Greek philosophy. (2)

Latin.—Lucretius, with lectures. Roman literature. (2)

Essays and Original Orations.

Gymnasium. (2)

SECOND TERM.

Constitutional Law.—Lectures. (1)

History.—History of France. (2)

Philosophy.—Lectures on the history of modern philosophy. (1) Philosophy of history. Lectures. (2)

Christian Evidences.—Lectures. (1)

French.—Readings. Compositions. Lectures in French on modern French authors. (2) Or *German.*—Readings. Compositions. Lectures in German on modern German authors. (2)

Geology.—Lectures. Le Conte. (2)

Greek.—Pindar: selected odes. Greek literature. (2)

Latin.—Cicero: De Officiis. Lectures on the History of Classical Philology. (2)

Lectures on American and English Literature. (2)

Critique, Poem, Oration.

Preparation of Thesis.

Gymnasium.

THE LATIN-SCIENTIFIC COURSE.

The Latin-Scientific Course, leading to the degree of Bachelor of Science (B.S.), is based on Latin without Greek.

FRESHMAN CLASS.

FIRST TERM.

Mathematics.—Geometry (Chauvenet completed). (3) Plane trigonometry. (1)

Chemistry.—Lectures. Remsen's Inorganic Chemistry. (4)

German.—Joynes-Meissner's Grammar. Buchheim's Reader. (3)

Latin.—Cicero: De Senectute and De Amicitia. Livy begun. Prose composition. (3)

Physiology and Health.—Lectures. (1)

English.—Rhetoric. (1)

Essays.

Gymnasium. (2)

SECOND TERM.

Mathematics.—Olney's University Algebra, Part III. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

German.—Grammar. Reader (continued). Bernhardt's Novelletten-Bibliothek, I. (3)

History.—History of Greece. (2) History of Rome. (1) Roman antiquities.

Latin.—Livy (completed). Horace: Odes and Epodes. Composition and prosody. (4)

English.—Rhetoric. Trench: English, Past and Present. (1)

Essays.

Gymnasium. (2)

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical geometry: Olney's General Geometry. (4)

Physics.—Lectures. (3)

French.—Whitney's Practical French Grammar. Super's Reader. (2)

German.—Harris's Prose Composition. Bernhardt's Novelletten-Bibliothek, II. (2)

History.—History of Rome. (1) Antiquities.

Latin.—Horace: Satires and Epistles. Composition. (2)

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

SECOND TERM.

Mathematics.—Differential and integral calculus: Olney. (4)

French.—Grammar. Reader (continued). (2)

German.—Harris. Riehl: Culturgeschichtliche Novellen. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2)

History.—Weber's Outlines of Universal History. (2)

Latin.—Tacitus: Agricola, Germania, and Annals, or Quintilian: Book X. Composition. (3) Antiquities.

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

JUNIOR CLASS.

FIRST TERM.

History.—Wilhelm Müller's Political History of Recent Times, and lectures. (2)

Philosophy.—Jevons's Lessons in Logic. (2)

English.—Coppée's English Literature. (4)

French.—Grammar. George Sand: La Mare au Diable. Dumas: Pauline. (2)

German.—Readings in Lessing, Herder, Goethe, Schiller, and contemporary authors. Dictation. Compositions. (2) Conversation class in German optional throughout the year.

Latin.—Letters of Cicero and Pliny. (3)
Essays and Original Orations.
Gymnasium. (2)

SECOND TERM.

History.—History of England: Hume. (3)
Philosophy.—Lectures on the outlines of physiological psychology. (2) Political economy. (1)
English.—Earle's Philology of the English Tongue. (2)
French.—Vigny: Le Cachet Rouge. Hugo: La Chute. Dictation. (2)
German.—Readings (continued). Dictation. Compositions. (2)
Latin. — Persius, Plautus, and Terence. History of Roman literature. (3)
Literature and History. (1)
Essays and Original Orations.
Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

International Law.—Lectures: Woolsey. (2)
History. — Decline and Fall of the Roman Empire: Gibbon. (3)
Philosophy.—Lectures on the history of ancient and medieval philosophy. (2)
Astronomy.—Young's General Astronomy. (3)
French.—Readings in Corneille, Racine, Molière, etc., and contemporary authors. Lectures on French literature. (2)
German.—Readings (continued). Compositions. Lectures on German literature. (1) Conversation class in both languages optional throughout the year.
Latin.—Lucretius, with lectures. Roman literature. (2)
Essays and Original Orations.
Gymnasium.

SECOND TERM.

Constitutional Law.—Lectures. (1)
History.—History of France. (2)

Philosophy.—Lectures on the history of modern philosophy. (1) Philosophy of history. Lectures. (2)

Christian Evidences.—Lectures. (1)

Geology.—Lectures. Le Conte. (2)

Latin.—Cicero: De Officiis. Lectures on the History of Classical Philology. (2)

French.—Readings (continued). Compositions. Lectures in French on modern French authors. (2)

German.—Readings (continued). Compositions. Lectures in German on modern German authors. (1)

Lectures on American and English Literature. (2)

Critique, Poem, Oration.

Preparation of Thesis.

Gymnasium.

COURSE IN SCIENCE AND LETTERS.

The Course in Science and Letters, leading to the Degree of Bachelor of Science (B.S.), is designed for those who wish to pursue both scientific and literary studies without Latin and Greek. These being omitted, extended instruction is given in French and German, History, General Literature, Mathematics and General Science.

FRESHMAN CLASS.

FIRST TERM.

Mathematics.—Geometry (Chauvenet completed). (3) Plane trigonometry. (1)

Chemistry.—Lectures. Remsen's Inorganic Chemistry. (4)

German.—Joynes-Meissner's Grammar. Buchheim's Reader. (3)

Drawing.—Elementary projections, shading and lettering. (2)

Physiology and Health.—Lectures. (1)

English.—Rhetoric. (2)

Essays.

Gymnasium. (2)

SECOND TERM.

Mathematics.—Olney's University Algebra, Part III. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

Chemistry.—Lectures and laboratory practice. Douglas and Prescott's Qualitative Analysis. (3)

History.—History of Greece. (2) History of Rome. (1)

German.—Grammar. Reader (continued). Bernhardt's Novelletten-Bibliothek, I. (3)

English.—Rhetoric. Trench: English, Past and Present. (2)

Essays.

Gymnasium. (2)

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical geometry: Olney's General Geometry. (4)

Physics.—Heat, magnetism, and electricity. Lectures and recitations. Barker's Physics. (5)

French.—Whitney's Practical French Grammar. Super's Reader. (2)

German.—Harris's Prose Composition. Bernhardt's Novelletten-Bibliothek, II. (2)

History.—History of Rome. (1) Antiquities.

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

SECOND TERM.

Mathematics.—Differential and integral calculus. Olney. (4)

Physics.—Sound and light. Lectures and recitations. Barker's Physics. (3)

Zoölogy.—Lectures. Orton. (2)

English.—Coppée's Rhetoric, with Kellogg's Praxis. (1)

French.—Grammar. Readings (continued). (2)

German.—Harris. Riehl: Culturgeschichtliche Novellen. Freytag: Aus dem Staat Friedrichs des Grossen. (2)

History.—Weber's Outlines of Universal History. (2)
English.—Readings in English classics. (1)
Essays.
Gymnasium. (2)

JUNIOR CLASS.

FIRST TERM.

History.—Wilhelm Müller's Political History of Recent Times, and lectures. (2)
Philosophy.—Jevons's Lessons in Logic. (2)
English.—Coppée's English Literature. (4)
French.—Grammar. George Sand: La Mare au Diable. Dumas: Pauline. (2)
German.—Readings in Lessing, Herder, Goethe, Schiller, and contemporary authors. Dictation. Compositions. (2) Conversation class in German optional throughout the year.
Zoölogy.—Lectures on biology. (2)
Crystallography.—Lectures, with practical exercises in the determination of crystals. (2)
Essays and Original Orations.
Gymnasium. (2)

SECOND TERM.

History.—History of England: Hume. (3)
Philosophy.—Lectures on the outlines of physiological psychology. (2) Political economy. (1)
English.—Earle's Philology of the English Tongue. (2)
French.—Grammar. Vigny: Le Cachet Rouge. Hugo: La Chute. Dictation. (2)
German.—Lessing, Herder, Goethe, Schiller, Heine, etc. Compositions. (2)
Mineralogy.—Descriptive mineralogy, with practical exercises in the determination of minerals. (3)
Literature and History. (1)
Essays and Original Orations.
Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

International Law.—Lectures: Woolsey. (2)

History.—Decline and Fall of the Roman Empire. (3)

Philosophy.—Lectures on the history of ancient and medieval philosophy. (2)

Astronomy.—Young's General Astronomy. (3)

French.—Readings in Corneille, Racine, Molière, etc., and contemporary authors. Compositions. Lectures on French Literature. (2)

German.—Readings (continued). Compositions. Lectures on German Literature. (1)

In both languages conversation class optional throughout the year.

Geology. — Williams' Lithology and laboratory practice. (2)

Essays and Original Orations.

Gymnasium.

SECOND TERM.

Constitutional Law.—Lectures. (1)

History.—History of France. (2)

Philosophy.—Lectures on the history of modern philosophy. (1) Philosophy of history. Lectures. (2)

Christian Evidences.—Lectures. (1)

French.—Readings (continued). Compositions. Lectures in French on modern French authors. (2)

German.—Readings (continued). Compositions. Lectures in German on modern German authors. (1)

Geology. — Historic and dynamic geology. LeConte. (3)

Lectures on American and English Literature. (2)

Critique, Poem, Oration.

Preparation of Thesis.

Gymnasium.

THE SCHOOL OF TECHNOLOGY.

This school includes seven distinct courses:

I. The Course in Civil Engineering.
II. The Course in Mechanical Engineering.
III. The Course in Mining Engineering.
IV. The Shorter Course in Mining.
V. The Course in Electrical Engineering.
VI. The Course in Chemistry.
VII. The Course in Architecture.

These have the same curriculum of studies for the first term of the Freshman year; except that students who propose to take the course in Mechanical Engineering or that in Analytical Chemistry are required to take German. After the first term the student follows the program of the course which he has selected.

FRESHMAN CLASS.

FIRST TERM.

Mathematics.—Chauvenet's Geometry (completed). (3) Plane trigonometry. (1)

Chemistry.—Lectures. Remsen's Inorganic Chemistry. (4)

French.—Whitney's Practical French Grammar. Super's Reader. (3) Or *German.*—Joynes-Meissner's Grammar. Buchheim's Reader. (3)

Drawing.—Free-hand sketching and lettering. (2)

English.—Rhetoric. (2)

Essays.

Physiology and Health.—Lectures. (1)

Gymnasium. (2)

THE COURSE IN CIVIL ENGINEERING.

The special technical studies in this course may be grouped under the heads of Surveying, Applied Mechanics, Road and Railroad Construction, Bridge Design, and Hydraulic and Sanitary Engineering.

The work in Surveying extends over four terms and embraces land surveying, leveling, topography, triangulation, railroad reconnaissance and location, hydrography, and the elements of geodesy. A large equipment of transits, levels, and other surveying tools affords students the opportunity of becoming familiar with the instruments of different manufacturers. Much time is devoted to practice in the field and drafting room, each student being required to become proficient in the use of instruments, in taking field notes, and in map-drawing. Particular attention is paid to the execution of topographical surveys and maps by the best modern methods. Railroad maps and profiles are made from actual field location. During the Senior year there is done secondary triangulation work of a high order of precision.

The work in Applied Mechanics comprises the strength and elasticity of materials, the theory of the equilibrium of arches, roofs and bridges, that part of the mechanics of machinery which relates to locomotives and hoisting machines, and the theory of hydraulics and hydraulic motors. Here the theoretical principles are illustrated by examples and problems taken as far as possible from actual engineering practice and a special report is required from each student on the testing machines of the Bethlehem Iron Company.

The course in Construction familiarizes the student with the qualities of materials used in engineering structures, with methods of preservation and testing, with masonry and foundations, and with the building and maintenance of roads and railroads. All the standard tests for hydraulic cements and mortars are made by each student.

The course in Bridge Design is preceded by the theory of computation of stresses by both analytical and graphic methods. Starting with the specifications for a first-class iron highway or railroad bridge, each student then makes the full computations, designs, working drawings, and bills of material for a plate girder, a lattice girder, and a pin-connected truss bridge. The weight of the designed bridge

is finally determined and compared with the dead load assumed for the calculations. The drawings are made and dimensioned in the same manner as in the drafting office of a bridge company. In connection with this course visits of inspection to bridges in the vicinity are regularly made.

The work in Hydraulic and Sanitary Engineering embraces the study of systems of water supply, the collection, purification, and distribution of water, the combined and the separate systems of sewerage, the methods for the disposal of sewage, and the best practice for the drainage and ventilation of houses. The hydraulic laboratory in the University Park affords opportunity for experiments on the actual measurement of water by means of weirs and orifices, and the testing of hydraulic motors.

Besides these special studies there is a course in astronomy, which includes practical work in the observatory. The study of English, and of French or German, is continued, and instruction is given during four terms in crystallography, mineralogy, lithology, and geology.

The student who completes all the studies of this course will receive the degree of Civil Engineer (C.E.).

FRESHMAN CLASS.

FIRST TERM.

See page 64.

SECOND TERM.

Mathematics.—Olney's University Algebra, Part III. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

French.—Grammar and reader (continued). (3) Or *German.*—Grammar and reader (continued). Bernhardt's Novelletten-Bibliothek, I. (3)

Construction.—Materials. Masonry. Carpentry. Roads and pavements. Sketches of structures. (2)

Drawing.—Descriptive geometry and isometric drawing. Tracings. Warren's Elementary Projection Drawing. (3)

English.—Rhetoric. Trench: English, Past and Present. (2)

Essays.

Gymnasium. (2)

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical geometry: Olney's General Geometry. (4)

Physics.—Heat, magnetism, and electricity. Lectures and recitations. Barker's Physics. (5)

French.—Grammar. George Sand: La Mare au Diable. Dumas: Pauline. (2) Or *German.*—Grammar. Bernhardt's Novelletten-Bibliothek, II. (2)

Drawing.—Architectural drawing. Plans of piers and arches. Problems in stone cutting. Use of water colors. (4)

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

SECOND TERM.

Mathematics.—Differential and integral calculus: Olney and Courtenay. (4)

Physics.—Sound and light. Lectures and recitations. Barker's Physics. (3)

French.—Grammar. George Sand: Le Cachet Rouge. Hugo: La Chute. Dictation. (2) Or *German.*—Grammar. Riehl: Culturgeschichtliche Novellen. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2)

Mechanics.—Theory of motion, statics, energy, center of gravity, moment of inertia, and general equations of motion. (4)

Surveying.—Theory and use of compass, level, and transit. Surveys and maps of farms. Leveling. (3)

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

JUNIOR CLASS.

FIRST TERM.

Mathematics.—Courtenay's Calculus, and Wood's Analytical Mechanics. (2)

French.—Corneille, Racine, Molière, Hugo, etc. Dictation. Compositions. (2) Or *German.*—Lessing, Herder, Goethe, Schiller, Heine, etc. Dictation. Compositions. (2) Conversation class in both languages optional throughout the year.

Surveying.—Triangulation. Topographical surveying with transit and stadia. Use of plane table. Topographical map. (4)

Strength of Materials.—Elasticity and strength of wood, stone, and metals. Theory of beams, columns, and shafts. Reports on the testing of materials. (4)

Construction.—Foundations. Specifications and estimates. Reports on structures. Tests of cements. (2)

Crystallography.—Lectures, with practical exercises in the determination of crystals. (2)

Essays and Original Orations.

Gymnasium. (2)

SECOND TERM.

French.—Readings. Compositions. Lectures on French literature. (2) Or *German.*—Readings. Compositions. Lectures on German literature. (2)

Surveying.—Theory of railroad curves. Railroad reconnaissance and location. Survey of a line, with profile, map, and estimate of cost. Lectures on construction and maintenance. (4)

Roofs and Bridges.—Theory and calculations of stresses in roof and bridge trusses. Graphic statics. (5)

Sanitary Engineering.—Collection, purification and distribution of water. Systems of water supply. The combined and the separate system of sewerage. Disposal of sewage. House drainage. (2)

Mineralogy.—Descriptive mineralogy, with practical exercises in the determination of minerals. (3)

Literature and History. (1)

Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

Astronomy.—Young's General Astronomy. (3)

Bridges.—Suspension, continuous, and cantilever bridges. Design of plate girders and riveted bridges, with working drawings. (6)

Surveying.—Use of solar transit and sextant. Precise triangulation. Elements of geodesy. Determination of the systematic errors of instruments. (3)

Mechanics of Machinery.—Pile drivers, cranes and elevators. The mechanics of the locomotive. (2)

Geology.—Williams' Lithology, with practical exercises in determining rocks. (2)

Gymnasium.

SECOND TERM.

Astronomy.—Doolittle's Practical Astronomy, with observatory work. (2)

Bridges.—Design of pin-connected bridges, with working drawings and estimates. (3)

Hydraulics.—Hydrostatics. Efflux of water from orifices and flow in pipes and rivers. Hydraulic motors. (2)

Construction.—Theory and designing of retaining walls, stone arches, and masonry dams. Irrigation and water-supply engineering. (3)

Geology.—Historic and dynamic. Le Conte. (3)

Lectures on American and English Literature. (2)

Christian Evidences.—Lectures. (1)

Preparation of Thesis.

Gymnasium.

THE COURSE IN MECHANICAL ENGINEERING.

The object of this course is the study of the Science of Machines. The principal subjects taught are: The nature, equivalence, and analysis of mechanisms, the mechanics or theory of the principal classes or types of machinery, Mechanical Technology, and the principles and practice of Machine Design.

That the students may obtain the practical engineering data which they will most need when beginning their work as mechanical engineers they are required to pursue a course of Shop Instruction which does not necessarily involve manual labor and manipulation of tools, but is principally devoted to familiarizing them with those points in pattern-making, moulding, forging, fitting and finishing, which they need to know as designers of machinery. Particular attention is therefore directed to the forms and sizes of machine parts that can be readily constructed in the various workshops, to the time that it takes to perform, and the order of, the various operations, to the dimensions most needed by workmen and to the various devices for increasing the accuracy of the work, durability of the parts, and convenience of manipulation. This involves acquaintance with the processes and machinery of the workshops, but it is the foreman's and superintendent's knowledge which is required rather than the manual dexterity and skill of the workman and tool-hand. The acquirements peculiar to the latter are by no means despised and the students are encouraged to familiarize themselves therewith during leisure hours, but manual work in the shops forms no regular part of the course. On the contrary, the student enters the shop with hands and mind free to examine all processes, operations, and machinery, and is ready at the call of the teacher to witness any operation of special interest. Provided with note-book, pencil, calipers, and measuring rule, the student sketches the most important parts of the various machine-tools, notes down the successive steps of each of the important shop-processes as illustrated by the pieces operated upon, and follows the

pieces of work through the shops from the pig or merchant form to the finished machine.

That the students may learn to observe carefully and be trained to think and observe for themselves in these matters, there is required of them a full description of the various processes, operations, and tools involved in the production of each one of a series of properly graded examples of patterns, castings, forgings, and finished pieces, which are not being constructed in the shops at the time and the blue prints for which have been given to them on entering the shops. The student's work is directed not only by these drawings and by the printed program given him at the start, but also personally by a teacher, who accompanies him into the shops, gives necessary explanations, and tests the extent and accuracy of his knowledge by examining the sketches and notes and by frequent questioning. Finally the results of the observations and the sketches are embodied in a memoir.

During the course there are frequent visits of inspection to the Bethlehem Iron Company, the L. V. R. R. Shops at Easton, and other engineering works both in and out of town, with special reference to such subjects as machine elements, prime movers, machinery for lifting, handling and transporting, and machinery for changing the form and size of materials. It is intended that each of these excursions shall have some definite purpose in view which must be fully reported by the students. These visits are also made the occasion for constant practice in the free-hand sketching of machinery.

The instruction in Machine Design begins with second term of the Freshman year and is continued throughout the course. At first tracings and blue prints of good examples of machine drawings are made. A thorough drill in projection drawing follows; in this work free-hand sketches are first made, and measurements taken, of machine pieces; these sketches are then converted into full-size working drawings. Then there is considerable practice in the interpretation of such drawings, and general views of lathes, planers, drills, and shapers are made from the draw-

ings of the details. This is followed by difficult projections and intersections and exercises in the empirical proportioning of machine parts. Both empirical and rational formulas are used to determine the dimensions of fastenings, bearings, rotating and sliding pieces, belt and toothed gearing, levers and connecting rods, the data being given as they would arise in practice and the drawings made full size. During the Junior year the class takes up the design of a high-speed steam engine, every dimension being determined by the students and complete drawings made. During the Senior year the students undertake the calculations, estimates, and working drawings involved in the design of a simple but complete machine, each student being engaged upon a different machine. From the finished drawings of each machine tracings are made and then blue prints taken for distribution among the other members of the class. In the case of the machines and of the engine the general plan or arrangement will be given to the students in the form of rough sketches, photographs, or woodcuts. In the last term the students are expected to make original designs for simple machinery, whose object has been fully explained. Throughout the course the work in the draughting-room is carried on as nearly as possible like that of an engineering establishment, and special attention is paid to methods of expediting the work of calculation by means of simple formulas, tables, and diagrams.

All the students in this course are required to study German.

The graduates in this course will receive the degree of Mechanical Engineer (M.E.).

FRESHMAN CLASS.

FIRST TERM.

See page 64.

SECOND TERM.

Mathematics.—Olney's University Algebra, Part III. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

German.—Grammar and reader (continued). Bernhardt's Novelletten-Bibliothek, I. (3)

Drawing and Machine Design.—Tracings and blue prints. Sketches and working drawings of machine pieces. Interpretation of machine drawing by isometric sketches. General views from given details. Sections of stub ends and valve passages. Intersection of boiler flues. Empirical proportioning of machine parts. (5)

English.—Rhetoric. Trench: English, Past and Present. (2)

Essays.

Gymnasium. (2)

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical geometry: Olney's General Geometry. (4)

Physics.—Heat, magnetism, and electricity. Lectures and recitations. Barker's Physics. (5)

Machine Design.—Proportioning of such machine parts as come under the head of fastenings, bearings, rotating and sliding pieces, belt and toothed gearing, levers, and connecting rods. (2)

Visits of Inspection.—Examination and sketching of principal machine parts in the shops of the vicinity. (2)

German.—Grammar. Bernhardt's Novelletten-Bibliothek, II. (2)

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

SECOND TERM.

Mathematics.—Differential and integral calculus: Olney and Courtenay. (4)

Physics.—Sound and Light. Lectures and recitations. Barker's Physics. (3)

German.—Grammar. Riehl: Culturgeschichtliche Novellen. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2)

Mechanics.—Theory of motion, statics, energy, center of gravity, moment of inertia, and general equations of motion. (4)

Steam Engine.—Holmes' Steam Engine. (3)

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

JUNIOR CLASS.

FIRST TERM.

Mathematics.—Courtenay's Calculus and Wood's Analytical Mechanics. (2)

German.—Lessing, Herder, Goethe, Schiller, Heine, etc. Dictation. Compositions. (2) Conversation class optional throughout the year.

Mechanics of Machinery.—Hermann-Smith. Graphical Statics of Mechanisms. (2)

Mechanical Technology.—Shop instruction. Examination of the processes and appliances involved in pattern-making, moulding, forging, fitting, and finishing, with sketches and reports. (5)

Boilers.—Wilson. Strength, construction, and wear and tear of boilers. (1)

Strength of Materials.—Elasticity and strength of wood, stone, and metals. Theory of beams, columns, and shafts. Reports on experimental tests. (4)

Essays and Original Orations.

Gymnasium. (2)

SECOND TERM.

German.—Readings. Compositions. Lectures on German literature. (2)

Kinematics of Machinery.—Reuleaux. Nature and equivalence of mechanisms. (3)

Machine Design.—Calculations and working drawings for a high-speed steam engine. (5)

Metallurgy.—Metallurgical processes. Furnaces. Refractory building materials. Combustion. Natural and artificial fuels. Metallurgy of iron. (4)

Machinery of Transmission.—Weisbach-Herrmann. (2)
Literature and History. (1)
Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

Thermodynamics. — General principles; application to steam engines and air compressors. (3)

Graphical Statics.—Graphical analysis of roof trusses and girders. (2)

Machine Design.—Calculations and working drawings for hoisting, pumping, and metal-working machinery. (4)

Kinematics.—Diagrams of the changes of position, speed and acceleration in mechanisms. Link and valve motions. Quick return motions. Parallel motions. Laying out of cams. (5)

Mechanics of Machinery.—Weisbach-Herrmann. Hoisting machinery, accumulators, cranes, and locomotives. (2)

Gymnasium.

SECOND TERM.

Mechanics of Machinery.—Weisbach-Herrmann. Pumps, pumping engines, blowing engines, compressors, and fans. (4)

Machine Design.—Original designs. (5)

Hydraulics.—Hydrostatics. Flow of water in pipes and channels. Hydraulic motors. (2)

Measurement of Power.—Indicating of steam engines; determination of evaporative efficiency of boilers; dynamometer experiments. (1)

Lectures on American and English Literature. (2)
Christian Evidences.—Lectures. (1)
Preparation of Thesis.
Gymnasium.

THE COURSES IN MINING ENGINEERING.

These courses aim to fit the student for practical work in either of the branches of mining, metallurgy, metallurgical chemistry, or geology. On account of the great number and scope of the studies necessary to the attainment of the degree of Engineer of Mines (E.M.), which includes that of Metallurgist, five years are required. At the end of the fourth year the student will have completed a course similar to that leading to the scientific degree in other institutions, and will receive the degree of Bachelor of Science (B.S.). On completing the first year, those who desire to practice mining alone are provided with a special course leading to the degree of Bachelor of Science (B.S.) in mining. The following program of subjects and studies shows the requirements for the degree of Engineer of Mines.

Modern Languages.—Although the option of studying French or German lies with the student, it may be well to note that the current literature of the subjects taught in these courses is more abundant in the latter language.

Drawing and Construction.—The course in machine design begins in the second term of Freshman year with tracings of good examples of machine drawings; then follow the interpretation of such drawings, and the making of general views of machines from detailed sketches; exercises in projection drawing from the same, and the proportioning of simple tools and machines. In Sophomore year the student becomes acquainted with the arrangement and details of metallurgical plant and in Senior year he designs the same. The post-graduate, during the entire year, becomes acquainted with and designs mining plant. The field work in mining and geological surveying is followed by map construction from field notes. Practice in mining and metallurgical construction is also afforded by the projects. In the shorter mining course, additional work in the construction of mining plant is introduced as early as the first term in Sophomore year.

CHEMISTRY. — The course in theoretical and applied chemistry extends over three years and includes work in wet and dry assaying of all the important ores and metallurgical products met with in actual practice, combined with the working of stoichiometric problems and the study of chemical philosophy. The practical work is that required for a metallurgical chemist or assayer.

With moderate care the expenses in this department need not exceed $120.

MINERALOGY.—This subject is divided into two courses. In the first course, after a short exposition of the laws of crystallography and a description of crystalline forms, practical exercises are held in the determination of simple and complex crystals, in which the student is taught to identify the various crystalline forms observed in minerals by the aid of models and of actual crystals, and with the use of the application goniometer. The second course includes the subjects of physical, descriptive, and determinative mineralogy. As in the first course, the greater part of the time is devoted to practical exercises, which, in this course, have for their object the determination of minerals. Each student is thus enabled to become familiar with the more common minerals by the actual handling of several hundred specimens, with the facility of making such tests as will not injure them. The presence of one or more instructors during each exercise permits the student to make frequent reports of his determinations, and to receive much instruction as to the characteristics of the minerals. The knowledge thus acquired can be supplemented by visits to the museum.

The course in blowpipe analysis may be considered as auxiliary to the practical exercises in determinative mineralogy. In the latter the student is urged to rely chiefly on physical tests; in the former he is required to determine minerals by the aid of the blowpipe.

The mineralogical laboratory offers facilities for an advanced course in crystallography and in physical and

microscopic mineralogy to a few students who may receive permission to pursue such a course.

GEOLOGY.—This subject is studied with special reference to the needs of the mining engineer. Within a radius of twenty miles the student meets and becomes acquainted with the rocks of the archæan, the palæozoic, and the mesozoic formations, and makes geological maps from his own field notes, paying attention to the lithological characters of the formations, as they are mainly non-fossiliferous south of the Blue Ridge. An extended practical course in lithology familiarizes the student with the rocks of importance to the mining engineer and enables him to determine them by sight. There are over 2000 specimens in the collection, embracing all the known species. The course in historic geology is illustrated by a cabinet of typical specimens. The course in economic geology supplements the above work by familiarizing the student with the geological horizon of all the valuable constituents of the earth's crust and the theories of their formation. As Bethlehem is near the center of the "extra-moraine" drift, exceptional facilities are afforded for the study of pleistocene geology in Eastern Pennsylvania.

ASTRONOMY.—After studying the theory of the subject two-thirds of the year are devoted to practical work in the observatory.

APPLIED MECHANICS.—This embraces hydraulics, a study of the steam engine, and the mechanics of machines employed in mining and metallurgy.

SURVEYING.—A course extending over three terms offers practice in land, mine, and geological surveying, leveling, topography, triangulation, railroad reconnaissance and location, and the use of the solar transit. It also includes practical work in drawing and map construction.

METALLURGY.—There are two courses of, together, about one hundred and forty lectures upon this subject, which

extend throughout a year. In these the chief object kept in view is a clear presentation of the principles involved in the various metallurgical processes, looked upon as the application to practice of the laws of chemistry, physics, and mechanics. This is followed, in the case of each process, by a description of the more important examples of the plant and of the methods of conducting the process, and by indications concerning its economic features. In order to ensure that the student shall understand the fundamental principles of metallurgy, and shall become so familiar with them as to be able readily to apply them, he is required to solve a series of problems in which these principles are involved. Many of the problems are such as are likely to present themselves to the metallurgist in his current practice.

The metallurgical laboratory affords opportunity for special investigations in subjects connected with metallurgy to such advanced students as are competent to conduct them.

MINING.—This subject is covered by three courses. The first begins with the application of economic geology to the needs of the engineer, so that he can study and value mining properties, locate appropriately the necessary plant, and calculate the cost of production. It includes the discussion of faults and the means of finding faulted bodies, with practical problems. The subjects of blasting, timbering, and winning deposits are applied to actual cases, as tunnel-driving, etc., and problems from practical data are solved by the students. The second course covers the subjects of underground and surface haulage; loading, unloading, and stocking ores; pumping; ventilation; hygiene and mining law. A series of problems is given in each of these subjects to cover cases that meet the engineer in ordinary practice. The third course treats of the mechanical preparation of ores by the wet, dry, or magnetic methods, and especially of the preparation of anthracite coal.

The location of the University in the vicinity of the iron works of the Lehigh Valley, and especially of the extensive

establishment of the Bethlehem Iron Company, affords unusual facilities for the practical study of iron metallurgy. The processes for the manufacture of spelter and oxide of zinc may be studied at the Bethlehem Zinc Works. The facilities for the practical study of mining and economic geology are not excelled by those of any other institution in the country. The zinc mines at Friedensville, the paint ores of the Marcellus formation, and the brown hematite and slate deposits of the Lehigh Valley are in the immediate vicinity, while within easy reach by rail are the semi-bituminous and anthracite coal fields, the block and fossil iron ores of the Clinton measures, the iron mines at Cornwall, Pennsylvania, and the iron and zinc mines of New Jersey; together affording examples of nearly all the methods of winning and dressing valuable deposits. Numerous visits of inspection are made in connection with the work of the course, to familiarize the student with metallurgical and mining processes and afford data for practical examples and projects.

THE COURSE IN MINING ENGINEERING.

This course is arranged so that the subjects which prepare the student for practice in the field of metallurgy shall be completed at the end of four years, when the graduate will receive the degree of Bachelor of Science in Metallurgy (B.S.). By remaining a year longer, and taking the subjects laid down for the post-graduate year, the graduate in the course may obtain the degree of Engineer of Mines (E.M.).

FRESHMAN CLASS.

FIRST TERM.

See page 64.

SECOND TERM.

Mathematics.—Olney's University Algebra, Part III. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

French.—Grammar and reader (continued). (3) *German.*—Grammar and reader (continued). Bernhardt's Novelletten-Bibliothek, I. (3)

Drawing.—Tracings and blue prints. Sketches and working drawings of machine pieces. Interpretation of drawings by isometric sketches. General views from given details. Sections of simple construction. Intersections of spheres, cones, cylinders, etc., illustrated from examples of mining and metallurgical plant. Graphical problems illustrating the direction and extent of throw in faults. (5)

English.—Rhetoric. Trench: English, Past and Present. (2)

Essays.

Gymnasium. (2)

SOPHOMORE CLASS.

FIRST TERM.

Mathematics. — Analytical geometry: Olney's General Geometry. (4)

Physics.—Heat, magnetism, and electricity. Lectures and recitations. Barker's Physics. (5)

French.—Grammar. George Sand: La Mare au Diable. Dumas: Pauline. (2) Or *German.*—Grammar. Bernhardt's Novelletten-Bibliothek, II. (2)

Drawing.—General views of metallurgical plant and detailed sketches. (2)

Surveying.—Theory and use of the level, compass, and transit. Surveys and maps of farms. (2)

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

SECOND TERM.

Mathematics.—Differential and integral calculus: Olney and Courtenay. (4)

Mechanics.—Theory of motion, statics, energy, center of gravity, moment of inertia, and general equations of motion. (4)

Chemistry.—Lectures and laboratory practice. Douglas and Prescott's Qualitative Analysis. (4)

Stoichiometry. (2)

French.—Grammar. Vigny: Le Cachet Rouge. Hugo: La Chute. Dictation. (2) Or *German.*—Grammar. Riehl: Culturgeschichtliche Novellen. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2)

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

JUNIOR CLASS.

FIRST TERM.

Mathematics.—Courtenay's Calculus and Wood's Analytical Mechanics. (2)

Strength of Materials.—Elasticity and strength of wood, stone, and metals. Theory of beams, columns, and shafts. Reports on the testing of materials. (4)

Crystallography.—Lectures, with practical exercises in the determination of crystals. (2)

Assaying.—Including the assay by the dry methods of gold, silver, antimony, lead, iron, and tin ores, coal, and gold and silver bullion. Laboratory work. Ricketts. (3)

Chemical Philosophy.—Tilden. Chemical calculations. Whiteley. (3)

French.—Corneille, Racine, Molière, Hugo, etc. Dictation. Compositions. (2) Or *German.*—Lessing, Herder, Goethe, Schiller, Heine, etc. Dictation. Compositions. (2)

Conversation class in both languages optional throughout the year.

Essays and Original Orations.

Gymnasium. (2)

SECOND TERM.

Metallurgy.—Metallurgical processes. Furnaces. Refractory building materials. Combustion. Natural and artificial fuels. Metallurgy of iron. (4)

Mineralogy.—Descriptive mineralogy, with practical exercises in the determination of minerals: E. S. Dana. (3)

Blow-Pipe Analysis. — Lectures, with practice. Plattner, Brush, or Nason and Chandler. (1)

Chemistry. — Fresenius' Quantitative Analysis. (4) The following analyses are executed by the student:

1. Iron wire (Fe).
2. Copper ore (Cu).
3. Silver coin (Au, Ag, Pb, Cu).
4. Zinc ore (Zn). By both gravimetric and volumetric methods.
5. Bronze (Cu, Sn, Zn, Pb).
6. Spiegeleisen (Mn).
7. Lead ore (PbS).
8. Ilmenite (TiO_2).
9. Iron ore (complete analysis).
10. Limestone (complete analysis).
11. Coal (volatile matter, fixed carbon, ash, H_2O, S, P).

Steam Engine.—Holmes' Steam Engine. (3)

French.—Readings. Compositions. Lectures on French literature. (2) Or *German.*—Readings. Compositions. Lectures on German literature. (2)

Literature and History.

Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

Metallurgy.—Of copper, lead, silver, gold, etc. (5)

Blow-Pipe Analysis.—Practice. (1)

Lithology.—Williams' Lithology, with practical exercises in determining rocks. (3)

Mechanics of Machinery.—Herrmann-Smith. The graphical statics of mechanisms. (2)

Chemistry. — Quantitative analysis: laboratory work: Fresenius. (3) The following analyses are executed by the student:

12. Slag (complete analysis).
13. Pig iron (complete analysis).
14. Carbon in steel (volumetric).

15. Nickel ore (Ni, Co).

16. Gas analysis.

Graphical Statics.—Graphical analysis of roof trusses and girders. (2)

Gymnasium.

SECOND TERM.

Mining.—Prospecting. Economic geology. Boring. Valuation of property. Methods of mining. Lectures. (3) Mechanical preparation of ores. Coal washing. Lectures. (2)

Drawing.—Designing of furnaces and other metallurgical plant. (2)

Mechanics of Machinery.—Hoisting machinery, accumulators, pumps, pumping-engines, blowing-engines, compressors, and fans. (4)

Hydraulics.—Hydrostatics. Flow of water in pipes and channels. Hydraulic motors. (2)

Lectures on American and English Literature. (2)

Christian Evidences.—Lectures. (1)

Preparation of Thesis.

Gymnasium.

POST-GRADUATE YEAR.

FIRST TERM.

Mining.—Underground transportation. Hoisting, drainage, and pumping. Ventilation and lighting. Hygiene of mines. Mining law. Lectures. (5)

Geology.—General geological definitions and principles. Dynamic geology. Le Conte. (2)

Drawing.—General views of mining plant and detailed sketches. (2)

Astronomy.—Young's General Astronomy. (3)

Surveying.—Triangulation. Leveling. Topographical surveys with transit and stadia. Topographical maps. (4)

SECOND TERM.

Geology.—Historic geology. Le Conte. (2)

Projects.—In geology and mining. Designing of mining plant. (3)

Surveying.—Geological survey: mapping and cross-sectioning. (2) Mine survey. Theory and practice, with construction of mine maps. Tunneling and shaft location. (2)

Surveying.—Theory of railroad curves. Railroad reconnaissance and location. Survey of a line, with profile, map and estimate of cost. Lectures on construction and maintenance. (4)

Astronomy.—Doolittle's Practical Astronomy, with observatory work. (2)

Preparation of Thesis.

THE SHORTER COURSE IN MINING.

This course is so designed that the student who desires to pursue the practice of mining and ore-dressing, and who does not wish to take the full course, may be prepared for practice in four years, receiving the degree of Bachelor of Science in Mining (B.S.).

This course is identical with the preceding up to the end of the Freshman year.

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical geometry: Olney's General Geometry. (4)

Mining Technology.—Kinds and systems of timbering. Details of haulage and hoisting plant. Freehand, isometric, and detailed drawings. (5)

Surveying.—Theory and use of compass, level, and transit. Surveys and maps of farms. (2)

French.—Grammar. George Sand: La Mare au Diable. Dumas: Pauline. (2) Or *German.*—Grammar. Bernhardt's Novelletten-Bibliothek, II. (2)

Crystallography.—Lectures, with practical exercises in the determination of crystals. (2)

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

SECOND TERM.

Mathematics.—Differential and integral calculus: Olney and Courtenay. (4)

Mechanics.—Theory of motion, statics, energy, center of gravity, moment of inertia, and general equations of motion. (4)

Chemistry.—Lectures and laboratory practice. Douglas and Prescott's Qualitative Analysis. (4)

Mineralogy.—Descriptive mineralogy, with practical exercises in the determination of minerals: E. S. Dana. (3)

French.—Grammar. Vigny: Le Cachet Rouge. Hugo: La Chute. Dictation. (2) Or *German.*—Grammar. Riehl: Culturgeschichtliche Novellen. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2)

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

JUNIOR CLASS.

FIRST TERM.

Mathematics.—Courtenay's Calculus and Wood's Analytical Mechanics. (2)

Strength of Materials.—Elasticity and strength of wood, stone, and metals. Theory of beams, columns, and shafts. Reports on the testing of materials. (4)

Geology.—General geological definitions and principles. Dynamic geology. Le Conte. (2)

Lithology.—Williams' Lithology, with practical exercises in determining rocks. (3)

Surveying.—Triangulation. Leveling. Topographical surveys with transit and stadia. Use of plane table. Topographical map. (4)

French.—Corneille, Racine, Molière, Hugo, etc. Dictation. Compositions. (2) Or *German.*—Lessing, Herder, Goethe, Schiller, Heine, etc. Dictation. Compositions. (2) Conversation class in both languages optional throughout the year.

Essays and Original Orations.

Gymnasium. (2)

SECOND TERM.

Geology.—Historic geology. Lectures. LeConte. Dana. (2)

Mining.—Prospecting. Economic geology. Boring. Valuation of property. Systems of mining. Lectures. (3)

Steam Engine.—Holmes' Steam Engine. (3)

Surveying.—Theory of railroad curves. Railroad reconnaissance and location. Survey of a line, with profile, map, and estimate of cost. Lectures on construction and maintenance. (4)

Drawing.—Construction of mining plant and detailed sketches. (2)

French.—Readings. Compositions. Lectures on French literature. (2) Or *German.*—Readings. Compositions. Lectures on German literature. (2)

Literature and History.

Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

Mining.—Underground transportation. Hoisting, drainage, and pumping. Ventilation and lighting. Hygiene of mines. Mining law. Lectures. (5)

Graphical Statics.—Graphical analysis of roof-trusses and girders. (2)

Astronomy.—Young's General Astronomy. (3)

Surveying.—Use of solar transit and sextant. Precise triangulation. Elements of geodesy. Determination of the systematic errors of instruments. (3)

Assaying.—Including the assay by the dry methods of gold, silver, antimony, lead, iron, and tin ores, coal, and gold and silver bullion. Laboratory work. Ricketts. (3)

Gymnasium.

SECOND TERM.

Mining.—Mechanical preparation of ores. Coal washing. (2)

Projects.—In mining. Designing of mining plant. (3)

Blow-Pipe Analysis.—Lectures, with practice. Plattner, Brush, or Nason and Chandler. (1)

Surveying.—Geological survey: mapping and cross-sectioning. (2) Mine survey. Theory and practice, with construction of mine maps. (2)

Hydraulics.—Hydrostatics. Flow of water in pipes and channels. Hydraulic motors. (2)

Lectures on American and English Literature. (2)

Christian Evidences.—Lectures. (1)

Preparation of Thesis.

Gymnasium.

THE COURSE IN PHYSICS AND ELECTRICAL ENGINEERING.

In the arrangement of the details of this new course the object has been to provide for those who seek to fit themselves as Electrical Engineers a preliminary training as complete and broad as that given to the members of the other schools. The requirements for admission, the mathematical and English studies, the modern languages and other outside branches are the same as those in the other technical courses. To these have been added such portions of the Mechanical Engineering Course, with which this course is most closely allied, as are necessary to give the student a general but sufficiently accurate knowledge of machinery.

This preparation joined to the unusually full development of Physics—and especially of Electricity—will, it is thought, make a course sufficiently comprehensive and thorough for the proper training of candidates for this degree. The great success attending the large majority of

the young men who have taken the one year's course in Electricity, in their subsequent electrical work, warrants the belief that this broader and more extended course will attain its object.

The main feature of this new course is the prominence given to the subject of Physics. This extends through three years, and while Electricity is specially developed the other branches, Elementary Mechanics, Heat and Light, are fully provided for. The opportunity is thus given to any one who wishes to acquire a more extensive knowledge of Physics than the University curriculum has heretofore offered. The student is well drilled in the theory by means of lectures and recitations, which carefully cover the whole subject, and he is required to go over the ground himself in the best of all schools—the working laboratory. Enough of work on each topic is given him to render him familiar with his subject. Much prominence is given to work that brings out the resources of the student himself, such as the construction of instruments and original investigation. He is encouraged to this and a regular portion of his time is set apart for this object.

It will be seen from the preceding statement that this course offers two great advantages: the thorough and extensive training of those intending to take part in the great development of Electric Science in the industrial field now going on and the facilities offered to those who wish to take a four years' course specially devoted to the whole branch of Physics.

The practical work of the Physical Laboratory is too extensive to allow of full details being given in the following arrangement of the course. The more important subjects developed may be mentioned here. In Mechanics, exact measurements, specific gravity, barometric leveling. In Heat, calorimetry and hygrometry. In Light, testing of optical instruments, spectroscopic analysis and photometry. In Meteorology, observations for several months as taken in the U. S. Signal Service stations, with all the usual corrections and reductions; construction of charts; mapping curves; reports, etc. In Magnetism, study of laws of force,

determination of moments of magnets and of horizontal components of intensity of earth's magnetism in absolute units. Attention is also given in the Junior year, both in lectures and laboratory work, to the investigation of the magnetic properties of iron magnetic moment, intensity of magnetization, magnetic induction, permeability, susceptibility, hysteresis, etc. In Electricity, management of batteries, construction of instruments and their calibration, measurement of resistance and other electrical measurements, electrolysis and relation of electrical currents to heat and mechanical work; study of direct and alternating current dynamos and motors and practical running, care and tests for efficiency, etc.; a determination of the resistance, characteristics, and saturation curves, exploration of field, coëfficient of magnetic leakage, etc.; electric lighting, with photometric tests of arc and incandescent lamps; measurement of heat units given off by lamps, their resistance (hot and cold); energy consumed in lamps; spectroscopic tests of purity of carbons; study of telegraph and telephone and of the application of electricity to street railways; visits to manufactories, working systems, electric railways, etc.

The work in Dynamo Design consists of a study of the principles of dynamo-electric machinery by lectures and recitations, and also of the practical calculation and design of dynamos for incandescent work, multipolar generators, stationary motors and street railway motors, alternate current apparatus, including generators, motors, and transformers. The design of street railway systems is also taken up, and long distance transmission by power. The preparation of the Thesis forms an important part of the work for the Senior year. It will consist of original investigation and research, in theoretical or applied electricity, approved by the professor of physics. The student is thrown upon his own resources as much as possible, and is made to rely on himself.

Through the generosity of members of the Board of Trustees, an important addition has been made to the apparatus of this department. It includes a 50 h. p. engine,

an 80 cell storage battery, some machines for advanced alternating current work, a 2-phase alternator and motor, etc.; a lathe and workshop tools, and a number of standard instruments of the finest kind for exact electrical measurements. This addition to the equipment of the department will enable it to carry out satisfactorily the advanced and broadened course which has been arranged for the present year.

A deposit of $20 for the first term and $15 for the second is required from each student before he is allowed to work in the laboratory. From this, at the end of the year, is retained the cost of any material wasted or apparatus injured by him during the term.

The degree of Electrical Engineer (E.E.) will be given to the graduates of this course.

FRESHMAN CLASS.

FIRST TERM.

See page 64.

SECOND TERM.

Mathematics.—Olney's University Algebra, Part III. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

Chemistry.—Lectures and laboratory practice. Douglas and Prescott's Qualitative Analysis. (2)

French.—Grammar and reader (continued). (3) Or *German.*—Grammar and reader (continued). Bernhardt's Novelletten-Bibliothek, I. (3)

Drawing.—Descriptive geometry and isometric drawing. Warren's Elementary Projection Drawing. (3)

English.—Rhetoric. Trench: English, Past and Present. (2)

Essays.

Gymnasium. (2)

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical geometry: Olney's General Geometry. (4)

Physics.—Heat. Magnetism and electricity. Lectures and recitations; text-book, Barker's Physics. (3)

Mechanics, Sound and Heat.—(Physical laboratory.) (4)

Machine Design.—(2)

French.—Grammar. George Sand: La Mare au Diable. Dumas: Pauline. Or *German.*—Grammar. Bernhardt's Novelletten-Bibliothek, II. (2)

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

SECOND TERM.

Mathematics.—Differential and integral calculus: Olney and Courtenay. (4)

Heat (continued), Magnetism, and Light.—(Physical Laboratory). (3)

Chemistry.—Lectures on Photography.

French.—Grammar. Vigny: Le Cachet Rouge. Hugo: La Chute. Dictation. (2) Or *German.*—Grammar. Riehl: Culturgeschichtliche Novellen. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2)

Mechanics.—Theory of motion, statics, energy, center of gravity, moment of inertia, and general equations of motion. (4)

Steam Engine.—Holmes' Steam Engine. (3)

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

JUNIOR CLASS.

FIRST TERM.

Mathematics.—Courtenay's Calculus and Wood's Analytical Mechanics. (2)

French.—Corneille, Racine, Molière, Hugo, etc. Dictation, Compositions. (2) Or *German.*—Lessing, Herder, Goethe. Schiller, Heine, etc. Dictation. Compositions. (2) Conversation class in both languages optional throughout the year.

Physics.—Electricity and Magnetism. Lectures with recitations; text-book, Slingo and Brooker's Electrical Engineering. (3)

Electricity; Electrical Measurements.—(Physical laboratory.) (3)

Meteorology.—Text-book and practice. (1)

Strength of Materials.—Elasticity and strength of wood, stone and metals. Theory of beams, columns, and shafts. Reports on the testing of materials. (4)

Boilers.—Wilson. Strength, construction and wear and tear of boilers. (1)

Essays and Original Orations.

Gymnasium. (2)

SECOND TERM.

Dynamo Design.—Text-book, S. P. Thompson's Dynamo-electric Machinery, with lectures. (3)

Magnetic Properties of Iron.—Text-book, Ewing's Magnetic Induction in Iron. (2)

Electrical Measurements; Magnetic Properties of Iron. Physical laboratory. (4)

French.—Readings. Compositions. Lectures on French Literature. (2) Or *German.*—Readings. Compositions. Lectures on German literature. (2)

Surveying.—Theory and use of instruments. Location and construction of electric railways. (2)

Applications of Electricity.—Telegraphs and telephones. (2)

Literature and History. (1)

Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

Dynamo Design.—The design of continuous current apparatus, dynamos, multipolar generators, motors. (3)

Dynamic Machines and Electric Lighting.—Study of, practice in running and care of, determination of characteristic and saturation curves, exploration of field, etc. Tests of efficiency, photometric and spectroscopic tests of lamps, etc. (Physical laboratory.) (5)

Alternating Currents.—Recitations with text-book. (3)

Measurement of Power.—Indicating of steam engines and dynamometer experiments. (1)

Astronomy.—Young's General Astronomy. (3)

Mechanics of Machinery.—Herrman-Smith. The graphical statics of mechanisms. (2)

Gymnasium.

SECOND TERM.

Dynamo Design (continued).—Design of alternating current apparatus. (2)

Electric Railways.—Recitations. Plans for an electric railway, with maps, specifications, etc. Long distance transmission of power. (2)

Hydraulics.—Flow of water through orifices, pipes, and channels. Hydraulic motors. (2)

Lectures on English and American Literature. (2)

Christian Evidences. (1)

Preparation of Thesis.

Gymnasium.

THE COURSE IN CHEMISTRY.

This course of study is designed to prepare students for the profession of the chemist, in connection with metallurgical establishments, sugar refineries, gas works, superphosphate works, electrical machinery manufactories, mining companies, etc., and the general consulting and analytical work of the professional chemist. It is also well adapted for the preparation of teachers of chemistry and as a preliminary course to the study of medicine. It is eminently practical, the student's time being largely occupied by practical work in the large, well equipped and well ventilated chemical laboratories, which were completed in

1885 and constitute the best constructed building for this purpose in this country. The museum of chemistry contains large collections of specimens, for illustrating the lectures on theoretical and applied chemistry.

THEORETICAL CHEMISTRY.—Instruction in this subject begins with lectures four times a week, in the first term of the Freshman year. These lectures are fully illustrated by experiments, colored diagrams, working drawings and lantern pictures, and specimens from the museum. They include a general introduction to theoretical chemistry, and a description of the non-metallic and metallic elements and their compounds, the general subject of inorganic chemistry. The students are required to take notes of the lectures, and to pass a written examination at the end of the term.

In the second term of this year stoichiometry and chemical problems and reactions are taught by recitations twice each week.

The study of theoretical chemistry is continued throughout the Sophomore year by recitations three times a week from Tilden's Chemical Philosophy, Whiteley's Chemical Calculations, and Remsen's Chemistry, in the first term of the Junior year, by a course of lectures and recitations on theoretical organic chemistry, four times a week and twice a week in the second term. These lectures are illustrated by experiments and by specimens from the museum of chemistry.

Written examinations are held at the close of each of the above courses.

ANALYTICAL CHEMISTRY.—Qualitative analysis is taught in the second term of the Freshman year, by lectures, recitations, and practical work in the qualitative laboratory, twelve hours of practical work per week being required. This laboratory is a large, well ventilated, and well lighted room, supplied with convenient working tables, vacuum filtration, hoods for noxious vapors, steam

baths, gas and washing appliances, and a commodious room for hydrosulphuric acid. Distilled water is delivered by faucet in this room and the other large laboratories. At the close of the term a practical examination is held in this subject.

After completing this course, quantitative analysis is pursued throughout the Sophomore and the first term of the Junior years. This subject is taught by lectures, recitations, and practical work in the quantitative laboratory, which is equipped similarly to the qualitative laboratory, but is supplied in addition with apparatus for drying precipitates and residues, rooms for the chemical balances, for combustions, and for a reference library.

Twelve hours per week are required during the first term of the Sophomore year and fifteen hours during the second term of that year and the first term of the Junior year.

The course consists in gravimetric and volumetric analyses, as applied to the substances given in the lists farther on, accuracy being required in the determination of each constituent.

At the close of each term written examinations are held upon the theory and practice of quantitative analysis.

Gas Analysis is taught by lectures and laboratory practice in the gas laboratory. This laboratory is supplied with full and complete apparatus for gas analysis, according to Bunsen's processes, as well as apparatus for some of the more rapid methods. Mixtures of gases are required to be analyzed by the students, within certain limits of error, and a written examination, on the theory and practice, is held at the close of the course.

Assaying.—The assaying of ores by furnace assay, together with gold and silver bullion analysis, by processes practiced in the United States Mint, is taught by lectures and practical work in the first term of the Senior year, nine hours of practical work per week being required. The course includes the assaying of ores of lead, tin, anti-

mony, gold, silver, and iron, coal, and gold and silver bullion.

The assaying laboratory is supplied with large working tables, twenty-nine crucible and two iron furnaces, and eight muffle furnaces, with adjoining rooms for balances, and gold and silver bullion analysis.

A certain accuracy of results and a written examination as regards theory and practice are required.

ORGANIC CHEMISTRY.—The practical work in this subject is performed in the second term of the Junior year, fifteen hours per week being required, with conferences and recitations each week. The laboratory for this work is equipped similarly to the quantitative laboratory, in addition being supplied with steam, cold water and air blast upon the working tables, and a full supply of apparatus for the various determinations and experiments, including combustion furnaces, furnaces for heating sealed tubes, mercury pump, Hoffman's, Dumas' and Meyers' apparatus for vapor densities, nitrometers, chemical balances, etc.

The course consists of determinations of specific gravities, melting points, boiling points, vapor densities, chlorine, bromine, iodine, and sulphur of organic substances.

Combustion analysis, nitrogen determination, fractional distillation, and the preparation of fifty pure organic compounds and a number of analyses are included.

INDUSTRIAL CHEMISTRY.—A course of lectures is delivered upon this subject in the second term of the Senior year, illustrated by experiments, diagrams, lantern pictures, and specimens from the museum of chemistry. The working laboratories for this subject contain an apparatus for making illuminating gas, an alcohol still, worm and doubler, and a complete working model of a sugar refinery, including filters, vacuum pan, and centrifugal. There is also apparatus for use in the manufacture of chemicals, for dyeing, calico printing, and bleaching. In connection with these laboratories is a room containing a photometer and apparatus for determining the sulphur, ammonia, and

specific gravity of illuminating gas; also a laboratory for the testing of alcoholic liquors, sugar, molasses, bone black, soap, petroleum, paints, dyes, superphosphates, and other commercial products, with the necessary technical apparatus. The students make practical experiments in this direction, and, with an instructor, visit various industrial establishments in this neighborhood and in and around New York City.

Toxicology.—A course of lectures on this subject is given in the first term of the Junior year, illustrated by experiments and by the large collection of specimens of poisons from the museum of chemistry. This is supplemented by a short course of laboratory work on some of the common poisons.

Sanitary Chemistry.—During the second term of the Senior year attention is given to the qualitative and quantitative examination of air, water, food, disinfectants, and other subjects connected with this branch of the science. Special apparatus is provided for this work, as recommended by the best authorities on the subject.

Photographic Chemistry.—A well equipped photographic laboratory and dark rooms are provided, in which the students of the chemical course receive practical instruction.

Physiological Chemistry.—The examination of urine, blood, etc., receives a proper amount of attention.

The course also includes instruction in physics, mineralogy, blowpipe analysis, metallurgy, and geology, which are of great value to the chemist.

Microscopy.—Instruction in the use of the microscope is given in the first term of the Senior year.

In the Senior year the student is required to prepare a thesis on some subject, selected by the Professor of Chemistry, involving practical work in the laboratory in addition to the literary labor, each graduate thus making a contri-

bution to the progress of the science, as a preliminary to the reception of his degree.

The graduate of this course receives the degree of Analytical Chemist (A.C.).

Students, not candidates for a degree, are admitted for special courses in chemistry, of which they will receive certificates.

The laboratories are under the immediate charge of the Professor and Instructors of Chemistry and are open to the students from 8 o'clock A.M. to 6 o'clock P.M., including Saturdays. Students are at liberty to work in the laboratories beyond the required hours as their time may permit. Students are charged for materials and apparatus consumed; with moderate care this expense need not exceed $50 per year.

FRESHMAN CLASS.

FIRST TERM.

See page 64.

SECOND TERM.

Mathematics.—Olney's University Algebra, Part III. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

Chemistry.—Lectures and laboratory practice. Douglas and Prescott's Qualitative Analysis. (4)

German.—Grammar and Reader (continued). Bernhardt's Novelletten-Bibliothek, I. (3)

Stoichiometry. (2)

English.—Rhetoric. Trench: English, Past and Present. (2)

Essays.

Gymnasium. (2)

SOPHOMORE CLASS.

FIRST TERM.

Chemical Philosophy. — Tilden. Chemical calculations. Whiteley. (3)

Quantitative Analysis.—Fresenius' Quantitative Analysis. (4)

The following analyses are executed by the student:

1. Iron wire (Fe).
2. Potassium dichromate (Cr_2O_3).
3. Barium chloride (Ba, Cl, H_2O).
4. Magnesium sulphate (MgO, SO_3, H_2O).
5. Disodium hydrogen phosphate (P_2O_5).
6. Rochelle salt (K_2O, Na_2O).
7. Volumetric determination of chlorine.
8. Acidimetry (HCl, H_2SO_4, HNO_3, $HC_2H_3O_2$).
9. Alkalimetry (KOH, NaOH, NH_4OH, soda ash, pearl ash).
10. Chlorimetry (bleaching powders).

Quantitative Analysis.—Conference. (1)

Physics.—Heat, magnetism, and electricity. Lectures and recitations. Barker's Physics. (5)

German.—Grammar. Bernhardt's Novelletten-Bibliothek, II. (2)

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

SECOND TERM.

Physics.—Sound and light. Lectures and recitations. Barker's Physics. (3)

German.—Grammar. Riehl: Culturgeschichtliche Novellen. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2)

Quantitative Analysis.—Fresenius' Quantitative Analysis. (5)

The following analyses are executed by the student:

11. Copper ore (Cu).
12. Zinc ore (Zn). By both gravimetric and volumetric Methods.
13. Lead ore (Pb, S).
14. Silver coin (Au, Pb, Ag, Cu).
15. Spiegeleisen (Mn).

16. Copper alloys (complete analysis).
17. Ilmenite (TiO_2).
18. Iron ore (complete analysis).
19. Limestone (complete analysis).
20. Coal (volatile matter, fixed carbon, ash, H_2 O, S, P).
21. Slag (complete analysis).

Quantitative Analysis.—Conference. (1)

Blow-Pipe Analysis.—Lectures, with practice. Plattner, Brush, or Nason and Chandler. (1)

Chemistry.—Remsen. Advanced course. (3)

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

JUNIOR CLASS.

FIRST TERM.

Toxicology.—Lectures. (2)

Quantitative Analysis.—Fresenius' Quantitative Analysis. (5)

The following analyses are executed by the student:

22. Guano (NH_3, P_2O_5, H_2O).
23. Clay (complete analysis).
24. Manganese ore (MnO_2).
25. Mineral water (complete analysis).
26. Pig iron (complete analysis).
27. Nickel ore (Ni, Co).
28. Carbon in steel (volumetric).
29. Gas analysis.

Quantitative Analysis.—Conference. (1)

Organic Chemistry.—Lectures and recitations. (4)

Crystallography.—Lectures, with practical exercises in the determination of crystals. (2)

German.—Lessing, Herder, Goethe, Schiller, Heine, etc. Dictation. Compositions. (2) Conversation class in both languages optional throughout the year.

Essays and Original Orations.

Gymnasium. (2)

SECOND TERM.

Organic Chemistry.—Laboratory. (5)

Organic Chemistry.—Lectures and conferences. (2)

Metallurgy.—Metallurgical processes. Furnaces. Refractory building materials. Combustion. Natural and artificial fuels. Metallurgy of iron. (4)

German.—Readings. Compositions. Lectures on German literature. (2)

Mineralogy.—Descriptive mineralogy, with practical exercises in the determination of minerals. E. S. Dana. (3)

Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

Metallurgy.—Of copper, lead, silver, gold, etc. (5)

Assaying.—Including the assay by the dry method of gold, silver, antimony, lead, iron, and tin ores, coal, gold and silver bullion, and rich lead. Ricketts. (3)

Industrial Chemistry.—Laboratory. (3)

Geology.—Williams' Lithology, with practical exercises in determining rocks. (3)

Microscopy.—Laboratory. (2).

Preparation of Thesis.

Gymnasium.

SECOND TERM.

Industrial Chemistry.—Lectures. (3)

Industrial Chemistry.—Laboratory. (3)

Industrial Chemistry.—Conference. (1)

Agricultural Chemistry.—Laboratory. (1)

Sanitary Chemistry.—Laboratory. (1)

Geology.—Historic and dynamic geology. Lectures. LeConte. (2)

Christian Evidences.—Lectures. (1)

Lectures on American and English Literature. (2)

Preparation of Thesis. (2)

Gymnasium.

THE COURSE IN ARCHITECTURE.

The studies in this course are closely allied with those in civil engineering, the higher surveying, railroad work, mineralogy, geology, and astronomy being omitted, instead of which architectural drawing and designing is substituted as seen in the following program. Instruction is also given in the history and æsthetics of architecture, in methods of heating and ventilating, in boilers and hoisting machinery, and in house drainage and sewerage.

During the first and second years the student lays the foundation for his professional work by the study of mathematics, physics, mechanics, drawing, surveying, English, and French or German. The course in drawing includes the use of water colors, free-hand, projection and isometric drawing, and their application to the general plans for a small building. In surveying there is field practice in the use of instruments, and also map drawing, thus enabling the student to understand the application of the subject to landscape gardening, and to the location of buildings.

During the third and fourth years of the course the work is of a more professional character. The subject of construction familiarizes the student with brick, stone, cement, and other materials, with foundations and masonry, with arches, piers, and walls, and with the stone-cutter's art. There is a full course in the theory and calculation of columns, beams, and shafts, in the strength of materials and its application to roof trusses and bridges. Working drawings of arches, piers, and roof trusses are made in detail. Plans and estimates are prepared for wooden, brick, stone, and iron buildings, the work being done according to standard specifications. In connection with the course visits of inspection are made to the numerous engineering structures in the Lehigh Valley and vicinity.

The student who completes all the subjects of this course will receive the degree of Bachelor of Science in Architecture (B. S.).

FRESHMAN CLASS.

FIRST TERM.

See Page 64.

SECOND TERM.

Mathematics.— Olney's University Algebra, Part III. (3) Plane and spherical trigonometry and mensuration. Use of logarithmic tables. (2)

Construction.—Materials. Masonry. Carpentry. Roads and pavements. Sketches and structures. (2)

French.—Grammar and Reader (continued). (3) Or *German.*—Grammar and Reader (continued). Bernhardt's Novelletten-Bibliothek, I. (3)

Drawing.—Descriptive geometry and isometric drawing. Tracings. Warren's Elementary Projection Drawing. (3)

English.—Rhetoric. Trench: English, Past and Present. (2)

Essays.

Gymnasium. (2)

SOPHOMORE CLASS.

FIRST TERM.

Mathematics. — Analytical geometry: Olney's General Geometry. (4)

Physics.—Heat, magnetism, and electricity. Lectures and recitations. (5)

French.—Grammar. George Sand: La Mare au Diable. Dumas: Pauline. (2) Or *German.*—Grammar. Bernhardt's Novelletten-Bibliothek, II. (2)

Drawing.—Architectural drawing. Plans of piers and arches. Problems in stone cutting. (4)

English.—Readings in English classics. (1)

Essays.

Gymnasium. (2)

SECOND TERM.

Mathematics.—Differential and integral calculus: Olney and Courtenay. (4)

Physics.—Sound and light. Lectures and recitations. (3)

French.—Grammar. Vigny: Le Cachet Rouge. Hugo: La Chute. Dictation. (2) Or *German.*—Grammar. Riehl: Culturgeschichtliche Novellen. Freytag: Aus dem Staat Friedrichs des Grossen. Dictation. (2)

Mechanics.—Theory of motion, statics, energy, center of gravity, moment of inertia, and general equations of motion. (4)

Surveying.—Theory and use of compass, level, and transit. Surveys and maps of farms. Leveling. (3)

English.—Readings in English classics. (1)

Essays.

Gymnasium.

JUNIOR CLASS.

FIRST TERM.

Mathematics.—Courtenay's Calculus, and Wood's Analytical Mechanics. (2)

French.—Corneille, Racine, Molière, Hugo, etc. Dictation. Compositions. (2) Or *German.*—Lessing, Herder, Goethe, Schiller, Heine, etc. Dictation. Compositions. (2) Conversation class in both languages optional throughout the year.

Strength of Materials.—Elasticity and strength of wood, stone, and metals. Theory of beams, columns, and shafts. Reports on the testing of materials. (4)

Construction.—Foundations. Specifications and estimates. Reports on structures. Tests of cements. (2)

Drawing.—Shades, shadows, and linear perspective. Sketches and designs for ornaments and simple details. (6)

Essays and Original Orations.

Gymnasium. (2)

SECOND TERM.

French.—Readings. Compositions. Lectures on French literature. (2) Or *German.*—Readings. Compositions. Lectures on German literature. (2)

Roofs and Bridges. — Theory and calculation of stresses in roof and bridge trusses. Graphical statics. (5)

Sanitary Engineering. — Collection, purification, and distribution of water. Systems of water supply. The combined and the separate system of sewerage. Drainage and sewerage of buildings. (2)

Architecture.—Designs and estimates for brick and stone buildings. (4)

History.—The history and styles of architecture. (2) Lectures on Roman antiquities. (1)

Literature and History. (1)

Gymnasium. (2)

SENIOR YEAR.

FIRST TERM.

Roofs and Bridges. — Cantilever, suspension, and arch bridges. Designs for plate girders and riveted roof trusses. (6)

Mechanics of Machinery.—Pile drivers, cranes, and elevators. (2)

Boilers.— Strength, construction, and wear and tear of boilers. Wilson. (1)

Architecture. — Specifications and estimates. Design for an iron building. (5)

Heating and Ventilation.—Systems of heating, lighting, and ventilating buildings. (2)

Gymnasium.

SECOND TERM.

Hydraulics. — Efflux of water from orifices, and flow in pipes and channels. Hydraulic motors. (2)

Construction.—Retaining walls, masonry dams, and stone arches. Plans and estimates. (3)

Roofs and Bridges.—Design for a pin-connected roof truss, with working drawings and estimates. (3)

Architecture.—Building superintendence. The æsthetics of architecture. Original plans, estimates, and specifications. (4)

Lectures on English and American Literature. (2)

Christian Evidences.—Lectures. (1)

Preparation of Thesis.

Gymnasium.

PHYSICAL CULTURE.

The Gymnasium is open morning, afternoon and evening, in all, 45 hours a week. Exercise in it is required of all students who are fitted to take it. Class drill with the Instructor and individual exercise are prescribed.

GRADUATING THESES.

Every student will be required to present a thesis upon some topic connected with his special course, as a necessary portion of the exercises for his final examination for a diploma. These theses shall be accompanied by drawings and diagrams, when the subjects need such illustration. The originals will be kept by the University, as a part of the student's record, for future reference; but a copy may be retained by the student, and be published, permission being first obtained from the President.

DIPLOMAS AND CERTIFICATES.

The Diploma is given only to those who have passed all the examinations in a regular course and is signed by the Secretary of the Board of Trustees and by the Faculty of the University. For all the partial courses a certificate is given, signed by the Secretary of the Faculty, and showing what the student has accomplished.

GRADUATE STUDENTS.

Graduate students wishing to remain a year or more and pursue a course of study as candidates for another Degree

may do so with the sanction of the Faculty. Those wishing to take *special* courses of study will be afforded every facility for so doing.

POST-GRADUATE DEGREES.

M. A.

The Faculty will recommend for the Degree of Master of Arts any candidate, otherwise properly qualified, who, after taking at this University the Degree of Bachelor of Arts, shall pursue, for at least one year at this University, or two years elsewhere, a course of liberal study prescribed by the Faculty in at least two departments (under at least two professors), pass a thorough examination in the same, and present a satisfactory Thesis.

M. S.

The Faculty will recommend for the Degree of Master of Science any candidate, otherwise properly qualified, who, after taking at this University the Degree of Bachelor of Science, or any Degree in the School of Technology, shall pursue, for at least one year at this University, a course of study prescribed by the Faculty in at least two departments (under at least two professors), pass a thorough examination in the same and present a satisfactory Thesis.

The Theses presented by candidates for Post-Graduate Degrees shall be retained by the University.

Applicants for either of these degrees will be required to complete the prescribed work within the allotted time. Special action of the Faculty is required for any extension of time.

THE UNIVERSITY LIBRARY.

The Library building was erected by the Founder of the University in 1877, at a cost of $100,000, as a memorial of his daughter, Mrs. Lucy Packer Linderman, and during the same year more than $20,000 were contributed by her family and friends as a memorial fund for the purchase of

books. By the will of the Founder of the University a fund of $500,000 has been given for the permanent endowment of the library.

The building is semi-circular in plan, with a handsome façade in the Venetian style of architecture. It is constructed of Potsdam sandstone with granite ornamentation. In the interior, the center is occupied as a reading space, fifty by forty feet, from which radiate the book cases, extending from floor to ceiling; two galleries affording access to the upper cases. Shelf room is now provided for one hundred and sixty thousand volumes. The building is thoroughly fireproof, well lighted, and heated by steam.

Ninety-seven thousand volumes are now upon the shelves, including many extremely valuable works. The list of periodicals numbers about two hundred and fifty, embracing as far as possible all departments of knowledge.

The Library is conducted strictly for consultation, and is open to the use of the public; both of which conditions are in accord with the terms of the gift.

REGULATIONS OF THE LEHIGH UNIVERSITY LIBRARY.

I. The Library is open every day, except Sundays and Legal Holidays, from 8 A.M. until 10 P.M., and on Sundays for the students and others connected with the University from 1.30 P.M. until 9.30 P.M.

II. Admission is free to all persons over 16 years of age.

III. Readers are required to write their names and addresses in the Daily Register of the Library. They also write the name of the book desired upon a Library Card, with their signatures, and present the same to the Director's Clerk, who supplies the book, retaining the card as a receipt. Before leaving the Library, readers return their books to the clerk, and receive their cards.

IV. The University Professors and Instructors, only, are allowed to take books from the Library Building.

V. No person is allowed to enter the alcoves, or remove any book from the shelves, without permission of the Director.

VI. Readers wishing to consult the more valuable illustrated works make special application for that purpose.

VII. In taking notes, pencils, and not pens and ink, are to be used.

VIII. Audible conversation and the use of tobacco are strictly forbidden in any part of the Library.

IX. Any person not conforming to these Regulations will be denied the privilege of the Library.

X. Any person who defaces, in any way, any book, magazine or paper, or the furniture, or any portion of the building, in addition to being deprived of the privileges of the Library will be prosecuted according to law.

OBSERVATORY.

By the liberality of Robert H. Sayre, Esq., one of the Trustees of the University, an astronomical observatory was erected on the University grounds, and placed under the charge of the Professor of Mathematics and Astronomy.

In the dome of the observatory is mounted an equatorial telescope, of six inches aperture, by Alvin Clark & Sons. The west wing contains a superior sidereal clock, by Wm. Bond & Sons; a zenith telescope, by Blunt, and a field transit, by Stackpole. There is also a prismatic sextant, by Pistor & Martins.

Students in practical astronomy receive instruction in the use of the instruments and in actual observation.

The grounds upon which the Observatory stands, consisting of seven acres of land adjoining the original grant, were presented to the University by Charles Brodhead, Esq., of Bethlehem.

THE UNIVERSITY MUSEUM.

In addition to the large collection illustrating all branches of Industrial Chemistry, the Museum includes collections in Metallurgy, Geology, Zoölogy, and Archæology.

The Metallurgical Cabinet already includes specimens illustrating the various processes for obtaining the more common metals.

The Zoölogical Cabinet includes the Werner collection of nearly all the types of American birds with their nests and eggs, and the Packer collection of recent shells.

The Geological Cabinet numbers over ten thousand specimens and includes the Palæontological, Mineralogical, Petrographic, and Economic collections. The first contains good specimens of nearly all the common genera. The Mineralogical division includes the Keim and Rœpper collections—the latter being especially complete and valuable from a crystallographic standpoint. The Petrographic division numbers several thousand specimens and, besides including numerous varieties of nearly all the rocks of the globe, contains a duplicate set from the collection of the Second Geological Survey of this State. The Economic division was formed and donated by Dr. James P. Kimball, ex-Director of the Mint, and formerly Professor of Economic Geology.

The Cummings Archæological Cabinet numbers three thousand specimens and includes Dr. Stubbs' collection of Indian relics, weapons, and utensils.

SUMMER SCHOOL OF SURVEYING.

A Summer School of Surveying, extending over a period of four weeks, is held at the University during the long vacation, provided that the attendance of at least twelve students is assured. In 1895 the school will open on Monday, June 24, at 8:30 A.M. Applications to join it should be made to the Professor of Civil Engineering before June 1, 1895. The tuition fee is $15, payable in advance.

Three courses in Surveying are offered in the Summer School:

A. Land and Town Surveying: corresponding to the course given to civil engineering students in the second term of the Sophomore year. This course is open to any student who has completed the Freshman year, or to any person having a good knowledge of geometry and trigonometry.

B. Topographical Surveying: corresponding to the course given to civil engineering students in the first term of the Junior year. This course is open to those who have completed course *A* or its equivalent.

C. Geodetic Surveying: corresponding to the course given to civil engineering students in the first term of the Senior year. This is open to those who have completed courses *A* and *B*.

At the close of the Summer School examinations are held and certificates given. Students of the University holding these certificates may omit the corresponding work in Surveying during the academic year and may, with the sanction of the Faculty, use the time thus gained in extra studies.

THE CHEMICAL AND NATURAL HISTORY SOCIETY OF THE LEHIGH UNIVERSITY.

This Society was organized in the Fall of 1871, as "The Chemical Society," but was afterwards expanded, as its present title indicates, and admits, by election, students from all departments of the University.

The collections of botanical and zoölogical specimens belonging to the Society are already important. During the past years persons have been sent to Texas and Brazil to collect specimens for these cabinets.

The Society has organized and maintained several courses of public scientific lectures.

Among the honorary members of the Society are more than one hundred of the most distinguished scientists in Europe and the United States.

THE ENGINEERING SOCIETY.

This Society was organized in 1873, and admits, by election, students in the Junior and Senior Classes. Its meetings are held fortnightly. At these, papers relating to engineering subjects are read and discussed. From 1885 to 1890 it issued quarterly five volumes of "The Journal of the Engineering Society," containing contributions by the members, alumni, and others. Many of the papers read before this society since 1890 have been published in "The Lehigh Quarterly," a journal published by the students of the University.

THE MINING CLUB.

This was organized in 1883 and takes from the Junior, Senior, and Post-Senior Classes those members of the Mining School who excel in their studies or in practical experience in the subjects of the course.

THE ELECTRICAL ENGINEERING SOCIETY

was organized in November, 1887, by students in the Advanced Course in Electricity. Its object is to supplement the regular work of the department by the study and discussion of electrical subjects.

THE AGORA

is a literary and debating society which meets semi-monthly. Once restricted in its membership to students in the School of General Literature, in 1893 it was thrown open to all the students. It has proved of great advantage to its members in the development of concise and logical

thinking, the promotion of ease before an audience, and the acquirement of experience in parliamentary methods. The society has recently joined the Inter-collegiate Debating Union, and it is expected that this will increase the interest already existing, and at the same time enlarge the knowledge of current affairs by the discussion of those subjects of the day which are prescribed by the Union.

THE CLASSICAL CLUB.

This organization was founded in the Spring of 1889, and consists of the students in the Classical and Latin-Scientific Courses, together with those members of the Faculty who are interested in this department of learning. At its monthly meetings, papers upon philological, historical, and archæological subjects are read by students belonging to the upper classes, and are then discussed and criticised. Thus independent work is encouraged and correct methods of investigation are acquired. This is especially valuable for those men who purpose becoming teachers or original investigators. Reports upon new discoveries and reviews of recent books vary the proceedings and keep the members informed in regard to the advances of philological science.

THE NATURAL SCIENCE CLUB OF THE LEHIGH UNIVERSITY.

The object of this organization is systematic study, in connection with field work, in natural history and its associated subjects. Its members are engaged in making a survey, both botanical and mineralogical, of the region within a radius of five miles from the University and propose to collect an herbarium and mineralogical cabinet which shall contain specimens of all the plants and minerals within this district.

THE ARCHITECTURAL CLUB.

This club was formed for the purpose of collecting photographic plates of buildings and plans, and to distribute

prints of these among its members. Working drawings, models, and specimens of building materials have also been collected. During the past year a series of monthly competitions in pen and ink drawings was held. The active members of the club are students in the architectural and engineering courses.

THE LEHIGH UNIVERSITY CHRISTIAN ASSOCIATION.

This is a voluntary organization of the students for the promotion of the religious, moral, and social life in the University. It was organized April 18, 1890, and on Oct. 11, 1890, united itself with the Intercollegiate Young Men's Christian Association. The movement is distinctly for and by students, all the officers being chosen from the student body. Those connected with Evangelical churches of whatever creed are eligible to *active membership; associate membership* may be claimed by men of good moral standing who are not members of churches. The association is continually growing, and is extending a marked influence for good among the men.

THE BIBLE CLASS.

A class for the reverent study of the sacred Scriptures, under the direction of the Chaplain, meets every Sunday afternoon at half past three o'clock. This class aims at both practical and theoretical results—the edification of its members in the Word of God, and the application of the (so-called) "scientific" or "historical" method to the study of Holy Writ.

FOUNDER'S DAY.

On the second Thursday of October of each year, Commemorative Exercises are held in honor of the Founder of the University. On Thursday, October 12, 1894, the sixteenth Founder's Day was celebrated. An address was delivered by La Rue Munson, Esq., of Williamsport, Pa.

UNIVERSITY SERMON.

This sermon is preached on the Sunday before University Day.

The Rt. Rev. Hugh Miller Thompson, S.T.D., LL.D., Bishop of Mississippi, was the preacher on Sunday, June 17, 1894, in the Memorial Church.

THESES.

Theses on the following subjects were prepared by candidates for degrees in 1894:

FOR THE DEGREE OF M.S.

"Reaction of certain alcohols on meta-diazo-benzene-sulphonic acids."

HERMAN EUGENE KIEFER, A.C.

FOR THE DEGREE OF B.A.

"The personality of George Eliot."

WILLIAM SPENCER MERRILL.

FOR THE DEGREE OF C.E.

"Review of the South Mountain Water Works, South Bethlehem, Pa."

LAWRENCE CALVIN BRINK.

"Gaugings of the Lehigh River above Calypso Island at Bethlehem."

EMOTT DAVIS BUELL.

"The stresses caused by suddenly applied loads and by impact."

JAMES LINDSEY BURLEY.

"The proposed ship canal between the Delaware and Raritan Rivers."

ALDEN BROWN DIVEN.

"Method for strengthening the Broad street bridge in Bethlehem."

WALTER JULES DOUGLAS.

"Design and detail drawings for a highway bridge of 198 feet span."

WALTER SEWELL DUNSCOMB.

"Design for a steel highway bridge over the Chemung River at Elmira, N. Y."

THADDEUS PERCIVAL ELMORE.

"Gaugings of the Lehigh River near the New Street bridge, Bethlehem; and a comparison of different kinds of floats."

JAMES DUBOSE FERGUSON.

"Experiments on the hydraulic jump, with a discussion and comparison of different theories."

ROBERT FERRIDAY.

"Design of two stone arches to replace a plate girder."

WILLIAM MCCLEERY HALL.

"Experiments on the lateral pressure of sand."

ANTON YOST HESSE.

"Stand pipes *versus* elevated tanks, with respect to economy."

FOSTER HAVEN HILLIARD.

"Review of the new bridge at West Catasauqua, Pa."

RICHARD WARREN KNIGHT.

"Precise leveling between South Bethlehem and Allentown, with a discussion of the errors."

CLAUDE AVERETT LANGDON.

"Review of the new highway bridge over the Lehigh River at Hokendauqua, Pa."

HARRY DONALDSON LEOPOLD.

"Design of a 50-foot drawbridge for class instruction and erection practice."

CARL WILLIAM FREDERICK NEUFFER.

"Plan for a sewerage system for Shenandoah, Pa."

JEREMIAH FRANCIS O'HEARN.

"Design of a separate system of sewerage for Pine Grove, Pa."

EDGAR EARNEST SEYFERT.

"Review of the plant of the Spring Brook Water Company, Pittston, Pa."

JACOB DANIEL VON MAUR.

"Discussion of a line of stadia levels from South Bethlehem to Allentown, Pa."

ALONZO LEACH WARE.

"Review of the sewerage system of Lehigh University."

AUBREY WEYMOUTH.

"Measurement of base lines by wooden rods and by tapes."

THOMAS WILLIAM WILSON.

"Plan for a new water supply for Bethlehem, Pa."

WELDON BURRIS WOODEN.

FOR THE DEGREE OF M.E.

"Production of solid steel castings."

IRVIN ISAAC BEINHOWER.

"A system of hydraulic cranes and accumulator for steel works."

THOMAS JOSEPH BRAY, JR., and
CLARENCE OLIVER LUCKENBACH.

"Design of 25 h. p. launch equipment."

REZEAU BLANCHARD BROWN, and
FRANK WILLIAM ROLLER.

"Experiments on effects of pipe connections on indicator diagrams."

BAYARD GUTHRIE.

"The direct conversion of heat into electrical energy."

FRANK WIESEMAN GLADING.

"Electric overhead traveling cranes."

MATTHIAS HARRY HOLZ.

"Efficiency of the locomotive boiler."
ALFRED A. HOWITZ.

"A feed water heater for locomotives."
GEORGE CASS HUTCHINSON.

"Economy of compound locomotives."
WILLIAM HARRISON KAVANAUGH.

"Fly-wheel acceleration permissible with incandescent lighting."
JAMES EDWIN LITTLE, and
WALTER CHRISTIAN SWARTZ.

"Methods of refrigeration."
JOHN VAN SICKLE MARTENIS, and
EDWIN GRAY RUST.

"Design of a tablet-compressing machine."
BENJAMIN FERDINAND SCHOMBERG.

"Hardening and tempering of steel."
ORSON WILLIAM TRUEWORTHY.

FOR THE DEGREE OF B.S.

(IN METALLURGY.)

"The tin plate industry."
WILLIAM A. ALLGAIER.

"Metallic carbonyls and their application to Metallurgy."
BARRY HOLME JONES.

"The desilverization of base bullion at the works of the Balbach Refining Co., Newark, N. J."
JOSEPH O. MATHEWSON, JR.

"The treatment of the zinc crust formed in Parkes' process as conducted by the Balbach Refining Co., Newark, N. J."
MATTHEW MCCLUNG, JR.

"Determination of the coefficient of discharge of a blowing engine supplying a blast furnace of the Thomas Iron Co."
GODWIN ORDWAY, and
CHARLES H. THOMPSON.

"The construction and testing of a new form of manometer."

WILLIAM VAUGHAN PETTIT.

FOR THE DEGREE OF B.S.

(IN MINING.)

"The drainage of the Friedensville zinc mines, and a system of water-supply therefrom."

GEORGE WASHINGTON SCOTT BATON.

"Rock-chute mining."

CHARLES BEECHER RUTTER.

"Experiments in the separation of slate from coal."

RUEL CHAFFEE WARRINER.

FOR THE DEGREE OF E.E.

"The design of an incandescent dynamo."

WILLIAM CONKLIN ANDERSON.

"Design of dynamo for incandescent lighting."

THEODORE GWATHMEY EMPIE.

"An incandescent light plant for Berwick, Pa."

FRANK FAUST.

"The Saucon Valley Traction Co."

JOHN JACOB FRANK.

"Design of a bipolar direct current dynamo."

LUTHER L. GADD.

"Original forms of telephones."

ELWOOD ARISTIDES GRISSINGER.

"Distribution of potential about commutators of dynamo machines."

FLETCHER DICKERMAN HALLOCK.

"Design of a constant potential dynamo."

WILLIAM EMLEY HOLCOMBE.

"An investigation of the iron losses in a transformer."

ARTHUR WILLISTON HENSHAW.

"The determination of magnetic hysteresis in certain specimens of iron."

JOHN DOUGLAS MCPHERSON, JR.

"Design of a 5-horse power electric motor."

CHARLES ASHER MOORE.

"Design of a switchboard for the Physical Laboratory of Lehigh University."

JULIUS LEDERER NEUFELD.

"Efficiency tests of batteries."

CHARLES ATWOOD NEWBAKER.

"Investigation of the magnetic leakage of a Westinghouse pony alternator and an Edison motor."

THOMAS CHARLES RODERICK.

"Design of an 80-horse power locomotive."

GEORGE ELWOOD SHEPHERD.

"Underground feeders."

CHARLES ELDER SHIPLEY.

"An electric road from Bethlehem to Freemansburg."

FREDERICK GEORGE SYKES.

"The lighting plant of a war ship."

PHILIP HENRY TROUT.

"Design of an electric railroad for the haulage of coal in the South Wilkes-Barre mines."

CLARENCE PORTER TURNER.

"The design of an incandescent dynamo."

CHARLES W. UNDERWOOD.

"Tests of the Westinghouse stopper lamp."

EDWARD OLMSTEAD WARNER.

FOR THE DEGREE OF A.C.

"The condensation of aldehydes with β-hydroxy α—naphthoquinone. The conversion of ortho- into para-, and of para- into orthoquinone derivatives."

WILLIAM COLWELL CARNELL.

"Fernaline."
MILTON BRAYTON GRAFF.

"Indigo."
GEORGE WASHINGTON HUNSICKER.

"Cocaine and the erythroxylon coca plant."
ARTHUR BACON JONES.

"Analysis and utilization of mine water."
RICHARD LESLIE OGDEN.

"The isolation of metallic manganese."
STEPHEN COLLINS POTTS.

FOR THE DEGREE OF B.S.
(IN ARCHITECTURE.)

"Design for an Alumni Hall for Lehigh University."
WILLIAM ARTHUR PAYNE.

"Design for a Presbyterian church at Summit Hill, Pa."
HERMAN SCHNEIDER.

UNIVERSITY DAY.

This day is the last of the academic year, and falls in 1895 on the third Wednesday in June. On this day orations are delivered by members of the graduating class, and degrees are conferred.

EXERCISES ON JUNE 20, 1894.

Reading of Scripture and Prayer by the Rev. Elwood Worcester, Ph.D., Chaplain of the University.

Salutatory Oration.—"Energy versus Fate."
REZEAU BLANCHARD BROWN.

Oration.—"Louis Kossuth."
WELDON BURRIS WOODEN.

Oration.—"The Progress of Engineering."
WALTER CHRISTIAN SWARTZ.

Oration.—"William the First, Emperor of Germany."
WILLIAM A. ALLGAIER.

Oration.—"The Poetry of Architecture."
WILLIAM ARTHUR PAYNE.

Oration.—"Remember the Alamo."
BARRY HOLME JONES.

Oration.—"Americanism."
*ELWOOD ARISTIDES GRISSINGER.

Valedictory Oration.
JULIUS LEDERER NEUFELD.

Award of the Wilbur Scholarship to
WARREN JOSHUA BIEBER,
of Bethlehem, first in rank in the Sophomore Class; with honorable mention of LEWIS BENJAMIN DAVENPORT, of Baltimore, Md.

The Wilbur Prizes were awarded as follows:

Freshman Class, Mathematics, to
AMBROSE EVERETT YOHN, of Saxton.
GILBERT CASE WHITE, of Richmond, Va.

Freshman Class, French, to
WALTER EVERETTE BROWN, of Stamford, Conn.

Freshman Class, German, to
CARL PIVANY NACHOD, of Philadelphia.

Freshman Class, Themes, to
THOMAS HALLY BISSELL, of Buffalo, N. Y.

Freshman Class, Rhetoric, to
ROBERT COLLYER NOERR, of Washington, D. C.

Freshman Class, Freehand Drawing, to
ERLE REITER HANNUM, of Pottsville.

Freshman Class, General Chemistry, to
OWEN GRAY MACKNIGHT, of Plains.

* Excused from speaking.

The following Degrees were conferred:

M. S.

HERMAN EUGENE KIEFER, A.C.

B. A.

WILLIAM SPENCER MERRILL.

C. E.

LAWRENCE CALVIN BRINK,
EMOTT DAVIS BUEL,
JAMES LINDSEY BURLEY,
ALDEN BROWN DIVEN,
WALTER SEWELL DUNSCOMB,
THADDEUS PERCIVAL ELMORE,
JAMES DU BOSE FERGUSON,
ROBERT FERRIDAY,
WILLIAM McCLEERY HALL,
ANTON YOST HESSE,
FOSTER HAVEN HILLIARD,
RICHARD WARREN KNIGHT,
CLAUDE AVERETT LANGDON,
HARRY DONALDSON LEOPOLD,
CARL WILLIAM FREDERICK NEUFFER,
JEREMIAH FRANCIS O'HEARN,
EDGAR EARNEST SEYFERT,
JACOB DANIEL VON MAUR,
AUBREY WEYMOUTH,
THOMAS WILLIAM WILSON,
WELDON BURRIS WOODEN.

M. E.

IRVIN ISAAC BEINHOWER,
THOMAS JOSEPH BRAY, JR.,
REZEAU BLANCHARD BROWN,
FRANK WIESEMAN GLADING,
BAYARD GUTHRIE,
MATTHIAS HARRY HOLZ,
ALFRED A. HOWITZ,

GEORGE CASS HUTCHINSON,
WILLIAM HARRISON KAVANAUGH,
JAMES EDWIN LITTLE,
CLARENCE OLIVER LUCKENBACH,
JOHN VAN SICKLE MARTENIS,
FRANK WILLIAM ROLLER,
BENJAMIN FERDINAND SCHOMBERG,
WALTER CHRISTIAN SWARTZ,
ORSON WILLIAM TRUEWORTHY.

B. S.
(IN METALLURGY.)

WILLIAM A. ALLGAIER,
BARRY HOLME JONES,
MATTHEW McCLUNG, JR.,
JOSEPH OTTO MATHEWSON, JR.,
GODWIN ORDWAY,
WILLIAM VAUGHAN PETTIT, JR.,
CHARLES HAMILTON THOMPSON.

B. S.
(IN MINING.)

GEORGE WASHINGTON SCOTT BATON,
CHARLES BEECHER RUTTER,
RUEL CHAFFEE WARRINER.

E. E.

WILLIAM CONKLIN ANDERSON,
THEODORE GWATHMEY EMPIE,
FRANK FAUST,
JOHN JACOB FRANK,
LUTHER L. GADD,
ELWOOD ARISTIDES GRISSINGER,
FLETCHER DICKERMAN HALLOCK,
ARTHUR WILLISTON HENSHAW,
WILLIAM EMLEY HOLCOMBE,
JOHN DOUGLAS McPHERSON, JR.,
CHARLES ASHER MOORE,

JULIUS LEDERER NEUFELD,
CHARLES ATWOOD NEWBAKER,
THOMAS CHARLES RODERICK,
GEORGE ELWOOD SHEPHERD,
CHARLES ELDER SHIPLEY,
FREDERICK GEORGE SYKES,
PHILIP HENRY TROUT, JR.,
CLARENCE PORTER TURNER,
CHARLES W. UNDERWOOD,
EDWARD OLMSTEAD WARNER.

A. C.

WILLIAM COLWELL CARNELL,
MILTON BRAYTON GRAFF,
GEORGE WASHINGTON HUNSICKER,
ARTHUR BACON JONES,
RICHARD LESLIE OGDEN,
STEPHEN COLLINS POTTS.

B. S.
(IN ARCHITECTURE.)

WILLIAM ARTHUR PAYNE,
HERMAN SCHNEIDER.

THE WILBUR SCHOLARSHIP.

This Scholarship was founded in 1872 by E. P. Wilbur, Esq., of South Bethlehem, and is the sum of $200 awarded annually to the student in the Sophomore Class having the best record.

THE ALUMNI SCHOLARSHIP.

The Alumni Association of the University has established a Scholarship of the value of $250 per annum, subject to the following conditions:

1. That the Scholarship shall only be awarded to a student in need of it.

2. That the Scholarship shall not apply to the first year of any student's course; he must without this aid have

gone through one year, and must be prepared to start the second year free from all conditions.

3. That the Scholarship shall not be continued to a student who shall at any time during his course carry any condition over eight weeks beyond the date of the examination in which he failed.

Subject only to the above conditions the disposal of the fund shall until otherwise directed be in the hands of the President of the University.

THE HENRY S. HAINES MEMORIAL SCHOLARSHIP.

Mrs. Henry S. Haines, of Savannah, Ga., has established a scholarship of the annual value of $200, which is to be devoted to the support at the Lehigh University, throughout his scholastic career, of one student in the School of Mechanical Engineering; the selection to be made by Mrs. Haines herself during her life-time.

WILBUR PRIZES.

By the generosity of E. P. Wilbur, Esq., a fund has been established, yielding an annual income of $100, for distribution in prizes as the Faculty shall determine.

ALUMNI PRIZES FOR ORATORY.

The "Alumni Association of the Lehigh University" has established an annual sum of Fifty Dollars, to be distributed as prizes for excellence in Oratory, subject to the following

REGULATIONS.

1. The Contest shall be held on the 22d day of February, or on the day designated by the University to commemorate the birthday of Washington.

2. There shall be a first prize of $25, a second of $15, and a third of $10.

3. To entitle one to be a competitor he must be a member of the Junior Class, taking a regular course.

4. Subjects for the oration shall be announced at the beginning of the first term of every year, and upon one of these each competitor shall write an oration not to exceed eight minutes in delivery.

5. Each oration shall bear upon its first page a fictitious name or motto, and shall be accompanied by a sealed envelope, which shall be superscribed with the same name or motto, and an address by which it may be reclaimed. The envelope shall contain the real name and address of the writer, with the declaration that the oration is his own original work. The examiner, having adopted a standard of excellence, may reject any or all of the orations presented which do not attain to this standard; of such as do —should they be sufficient in number—the best six shall be chosen, and their envelopes opened. The others shall be returned to the address given with their envelopes unopened.

6. The Executive Committee of the Alumni Association, or a committee of not fewer than three to be appointed by them, shall hear the competitors whose orations shall have been approved, and the awards shall be made by a majority of these judges.

7. In awarding the prizes the judges shall consider both the literary merits and the delivery of each oration.

8. These rules are subject to amendment by the Faculty.

At the last contest on February 22, 1893, the competitors were as follows:

Arthur Stebbins Clift, of Croton Falls, N. Y.
Walter Ferris, of Wilmington, Del.
Warren Byron Keim, of Reading.
William Allen Lambert, of Hellertown.
Fayette Avery McKenzie, of Montrose.
William Warr, of Philadelphia.

The First Prize was awarded to William Warr; the Second, to Arthur Stebbins Clift; the Third, to Fayette Avery McKenzie.

The next contest will take place February 22, 1895.

ENTRANCE EXAMINATION PAPERS.

Used for Examination in 1894.

[Requests for other examination papers than those herein printed can not be granted.]

I.—ENGLISH.

I.

1. Analyze the following sentence:

After a careful survey of the whole ground, our belief is that no such persons as Professor Teufelsdröckh or Counsellor Heuschrecke ever existed; that the six Paper-bags, with their China-ink inscriptions and multifarious contents, are a mere figment of the brain; that the present Editor is the only person who has ever written upon the Philosophy of Clothes; and that the *Sartor Resartus* is the only treatise that has yet appeared upon that subject;—in short, that the whole account of the origin of the work before us, which the supposed Editor relates with so much gravity, and of which we have given a brief extract, is, in plain English, a *hum*.

2. Distinguish between the uses of the Interrogative Pronouns *who*, *which*, and *what;* and illustrate by sentences.

3. What is a *collective noun?* What number of the verb is used with such a noun?

4. Give the principal parts of the following verbs: *swim*, *dive*, *awake*, *seethe*, *reave*.

5. When is the *colon* used in punctuation?

II.

1. Distinguish between *grammar* and *rhetoric*.

2. Define the following terms: *Purity*, *Barbarism*, *Figure of Speech*, *Solecism*, *Antithesis*.

3. Write a *Simile*, a *Personification*, a *Synecdoche*, a *Hyperbole*.

4. Write an essay of four hundred words on one of the following subjects:

The Plot against Cæsar (Shakespeare's *Julius Cæsar*).
Christian's Fight with Apollyon.
The Character of Ivanhoe.

This question counts as four on a scale of ten.

II.—GEOGRAPHY.

Outline maps of the Western part of the United States and of Northern Europe, were furnished to each applicant and he was required to draw the boundaries of countries, provinces, states, and territories, and name them, to place and name the capital or chief city of each, and the principal rivers and mountain systems.

III.—UNITED STATES HISTORY.

1. *a.* What was the London company?
   b. What grant of territory did it receive?
2. *a.* When and by whom was New York settled?
   b. What changes of government in New York from the time of its settlement until the Revolution?
3. *a.* What war finally settled the question of supremacy on the American continent between the English and French?
   b. What was the last important battle of this war?
   c. Who commanded each army?
4. *a.* What two campaigns in 1777?
   b. What was the result of each?
5. *a.* What four campaigns in the eastern part of the United States in 1862?
   b. Name the principal events in each?
6. *a.* What dispute was ended by the treaty of Washington, in 1871?
   b. What were the provisions of the treaty, and how were they carried out?

CONSTITUTION.

1. *a.* In what body are vested the legislative powers of the United States Government?
   b. Into what two parts is this body divided?

c. What are the qualifications for membership in each?

2. *a.* How are members of each of the two branches of the national legislature appointed among the several states?

   b. How is the presiding officer of each branch chosen?

3. What are the powers of the states under the Constitution?

4. What mention is made of freedom in *speech*, *religion*, and press?

IV.—ARITHMETIC.

1. Find the highest common divisor of 11308, 1200, and 1702, giving reason for each step of the work.

2. Find interest, discount, and bank discount on $40 from May 12th, 1876, to October 14th, 1877, @ 6 per cent.

3. How may a herd of 700 cattle be made up, of cattle worth $40 and $70 a head, that the average value of the herd may be $50 a head?

4. Reduce 9 gal. 3 qts. 2 gills to litres.

5. Bought a horse for 25 per cent. more than its true value, and sold it for 25 per cent. less. Find loss per cent.

6. Define:

   (*a*) Arithmetic, number, integer, repetend, fraction. Describe the method of reducing compound denominate numbers to integers of lower denominations, and the converse process.

   (*b*) How many rods in a mile; cubic inches in one bushel; cubic inches in a gallon; cubic feet in a cord; square rods in an acre; square miles in a township?

   (*c*) Define: Interest, duty ad valorem, annuity, ratio, and compound proportion.

V.—GEOMETRY.

1. In every parallelogram the opposite sides are equal and the opposite angles are equal, and conversely.

2. Two parallels intercept equal arcs on a circumference.

3. If through any fixed point in the plane of a circle a straight line is drawn intersecting the circumference, the product of the distances of the fixed point to the two points of intersection is constant.
4. Divide a straight line in extreme and mean ratio (with proof).
5. If the three sides of a right triangle be taken as the homologous sides of three similar polygons constructed upon them, then will the polygon constructed upon the hypothenuse be equivalent to the sum of the polygons constructed upon the other two sides.
6. Inscribe the regular decagon, and find length of one side in terms of the radius.
7. The circumference of a circle is the limit to which the perimeters of the regular inscribed and circumscribed polygons approach when the number of their sides is increased indefinitely; and the area of the circle is the limit of the area of these polygons.
8. Two diedral angles are in the same ratio as their plane angles (both when the plane angles are commensurable and when they are incommensurable).
9. (*a*) From a point without a plane one perpendicular can be drawn to the plane, and but one.
   (*b*) From a point within a plane one perpendicular can be erected to the plane, and but one.
10. Define: Plane, geometrical figure, geometry, centre of symmetry, rhomboid, sector, regular polygon.
    (*b*) Define the terms: Ratio, mean proportional, "reductio ad absurdum," ratio of similitude. When is one quantity said to be proportional to another? When is a line said to be harmonically divided?
    (*c*) Define: Limit, maximum, locus, polyedral and diedral angles. When are two figures said to be "equal by symmetry"?

VI.—ALGEBRA.

1. (*a*) Define an equation; homogeneous equation; simultaneous equations; root of an equation; quadratic equation.
   (*b*) Define exponents and coëfficients as symbols of operation (all cases; positive, negative, integral, and fractional).
   (*c*) Describe operations indicated by $(a-y)\{\sqrt{(2bx)}+x^2\}+\sqrt{\{(a-x)(b+y)\}}$. Express the following in symbols: The sum of a times the the square root of the difference of three times b and the second power of x, and x times the third root of the sum of three times x and the second power of y.

2. (*a*) Define a rule; a formula; a radical quantity, and give the different kinds.
   (*b*) Define a fraction; also the various kinds, proper, improper, etc.
   (*c*) Give rules for freeing a fraction of negative exponents, both when its terms are monomial and when they are polynomial.

3. Prove that $a-b$ is a factor of a^n-b^n when n is integral, and show what this statement becomes when b is negative.

4. Expand $(x^2-y)^{\frac{1}{2}}$ and $\dfrac{1}{x^{-\frac{1}{2}}-y^{\frac{1}{3}}}$ each to five terms by the binomial formula.

5. Reduce

$$\frac{x}{\sqrt[2]{-y^2}},\ \frac{x}{\sqrt[3]{(-y)^2}},\ \frac{x}{\sqrt[4]{-y^3}},\ \frac{5}{\sqrt[3]{4}+\sqrt[4]{3}},\ \text{and}\ \frac{5}{\sqrt[3]{4}+\sqrt[5]{3}}$$

   to forms having rational denominators.

6. Produce the formulæ showing relations of parts in a geometrical progression.

7. (*a*) $\dfrac{2x-1}{\sqrt{2x-1}}+1=\dfrac{\sqrt{2x}-1}{2}+2$. Solve and verify.

(*b*) If it takes a pieces of one kind of money to make a dollar and b pieces of another kind to make a dollar, how many of each must be taken in order that c pieces may be worth a dollar?

8. (*a*) At what time between 4 and 5 o'clock are the hands of a clock at right angles?

(*b*) A man sold two horses for $205 each: on one he gained 25% and on the other he lost 25%. Required the whole gain or loss.

9. (*a*) $$\begin{aligned} x+y&=10,\\ \sqrt{\frac{x}{y}}+\sqrt{\frac{y}{x}}&=\frac{5}{2}. \end{aligned}$$

(*b*) $$\begin{aligned} x^2-4y^2&=9,\\ 2y^2+xy&=3. \end{aligned}$$ Find x and y.

VII.—PHYSICS.

1. Define: (*a*) Dynamics.
(*b*) Kinetic unit of force.
(*c*) Difference of potential.
(*d*) E. M. F. of polarization in a cell.
(*e*) Watt.
(*f*) Resonance.
(*g*) Evaporation.
(*h*) Thermodynamics.
(*i*) Chromatic aberration.
(*j*) Conjugate foci.

2. Describe the Fahrenheit hydrometer and tell how it is used.

3. Explain the action of the electrophorus.

4. How would you find the latent heat of water experimentally?

5. How can the principal focal distance of a convex lens be found?

6. A body weighs 1115 lbs. in water, and 875 lbs. in another liquid whose specific gravity is 3. Find (*a*) its weight in air, (*b*) its volume, (*c*) its specific gravity.

7. A current of 10 amperes is sent through a resistance of 44.76 ohms. What electrical horse-power is required, and how many calories are generated in this circuit in ten minutes?

8. If a wire 1 m. long, weighing 1 g., has a resistance of 1.85 ohms, what must be the weight of 20 m. of wire of the same material having a resistance of 14.1 ohms?

9. At the ends of a lever 9 feet long are suspended 8 lbs. and 10 lbs. The lever is in equilibrium. Where is the fulcrum and how far must it be moved so that if 1 lb. is added to each of the weights they still balance?

10. Into a copper vessel weighing 50 g. and holding 500 g. of water at 10° c., was dropped a piece of lead at 100° c., and weighing 20 g. What was the resulting temperature? Sp. ht. of copper = .0952. Sp. ht. of lead = .0314.

11. With what velocity must a seven-pound ball strike an iron target weighing 70 lbs., to raise its temperature 17.7° F.? All the heat generated is to be applied to the target. Sp. ht. of iron = .1138.

12. At what distance must a rod 12 inches long be placed from a light so that it will cast a shadow 36 inches long on a screen 10 feet from the light?

VIII.—PHYSICAL GEOGRAPHY.

1. Give the causes of the change of seasons.

2. Give the causes of ocean waves, tides, and currents.

3. Describe and give causes of constant, periodical, and variable winds.

4. Define and tell how rain, fog, mist, clouds, dew, and snow are formed.

5. What is a rainbow and how formed?

6. What are the principal food-producing plants of the United States?

7. How are the United States divided in regard to distribution and quantity of rain.

IX.—LATIN.

I and II. Grammar and Cæsar.

Translate:

Cognito Cæsaris adventu, Ariovistus legatos ad eum mittit: quod antea de conloquio postulasset, id per se fieri licere, quoniam propius accessisset, seque id sine periculo facere posse existimare. Non respuit condicionem Cæsar, jamque eum ad sanitatem reverti arbitrabatur, cum id, quod antea petenti denegasset, ultro polliceretur; magnamque in spem veniebat, pro suis tantis populique Romani in eum beneficiis, cognitis suis postulatis, fore uti pertinacia desisteret. Dies conloquio dictus est ex eo die quintus. Interim saepe ultro citroque cum legati inter eos mitterentur, Ariovistus postulavit, ne quem peditem ad conloquium Cæsar adduceret: vereri se, ne per insidias ab eo circumveniretur; uterque cum equitatu veniret; alia ratione sese non esse venturum.—*De Bello Gallico I.* 42.

Decline *adventu*, *spem*, *legatos*, and give a scheme of the case endings of the five declensions. Decline *id*, *se*, *petenti*, *alia*, complete in all genders and both numbers. Compare *propius*. Explain the syntax of *postulasset*, *polliceretur*, *mitterentur*, *adduceret*, *venturum*. Give the rules for the use of verbs in the Indirect Discourse. Give the syntax of *adventu*, *pertinacia*, *conloquio*. Why is *spem* acc. and not abl.? Explain the form *postulasset*. Give the principal parts of *accessisset*, *arbitrabatur*, *polliceretur*, *fore*. Give the cardinal, the distributive and the adverb answering to *quintus*.

Translate:

His de rebus Cæsar certior factus, et infirmitatem Gallorum veritus, quod sunt in consiliis capiendis mobiles et novis plerumque rebus student, nihil his committendum

existimavit. Est enim hoc Gallicae consuetudinis, uti et viatores etiam invitos consistere cogant, et quid quisque eorum de quaque re audierit aut cognoverit quaerant; et mercatores in oppidis vulgus circumsistat, quibusque ex regionibus veniant quasque ibi res cognoverint pronuntiare cogant. His rebus atque auditionibus permoti de summis saepe rebus consilia ineunt, quorum eos in vestigio paenitere necesse est, cum incertis rumoribus serviant, et plerique ad voluntatem eorum ficta respondeant.

—*De Bello Gallico IV.* 5.

Why is *sunt* used and not the subj.? How does the construction *consiliis capiendis* differ from the English idiom? Give syntax of *consuetudinis*, *uti . . . . cogant*, *veniant*, *rumoribus*. Give synopsis of *cogant* in the First Person. Compare *mobilis*, *novus*, *summis*. Decline *vulgus*.

III. Cicero.

Translate:

1. Sed cur tam diu de uno hoste loquimur, et de hoste qui jam fatetur se esse hostem, et quem, quia (quod semper volui) murus interest, non timeo: de eis qui dissimulant, qui Romae remanent, qui nobiscum sunt, nihil dicimus? Quos quidem ego, si ullo modo fieri possit, non tam ulcisci studeo quam sanare sibi ipsos, placare rei publicae, neque id qua re fieri non possit, si me audire volent, intellego. Exponam enim vobis, Quirites, ex quibus generibus hominum istae copiae comparentur, deinde singulis medicinam consili atque orationis meae, si quam potero, adferam.

—*Cat. II,* 17.

Where and to whom was this oration delivered? Give syntax of *sibi*.

2. Qua re videant ne sit periniquum et non ferundum, illorum auctoritatem de Cn. Pompei dignitate a vobis comprobatam semper esse, vestrum ab illis de eodem homine judicium populique Romani auctoritatem improbari;

praesertim cum jam suo jure populus Romanus in hoc homine suam auctoritatem vel contra omnes qui dissentiunt possit defendere, propterea quod, isdem istis reclamantibus, vos unum illum ex omnibus delegistis quem bello praedonum praeponeretis.—*Manil. Law. XXII.*

IV. Vergil.

Translate:

1. Talia jactabam, et furiata mente ferebar:
cum mihi se, non ante oculis tam clara, videndam
obtulit et pura per noctem in luce refulsit
alma parens, confessa deam, qualisque videri
caelicolis et quanta solet, dextraque prehensum
continuit, roseoque haec insuper addidit ore:
'Nate, quis indomitas tantus dolor excitat iras?'
Aen. II. 588–594.

Syntax of *deam.* With what words is *ore* easily confounded? Scan lines 3 and 4, marking the feet and caesuras.

2. 'Phoebe, graves Trojae semper miserate labores,
Dardana qui Paridis direxti tela manusque
corpus in Aeacidae, magnas obeuntia terras
tot maria intravi duce te, penitusque repostas
Massylum gentes praetentaque Syrtibus arva,
jam tandem Italiae fugientis prendimus oras;
hac Trojana tenus fuerit Fortuna secuta.
Aen. VI. 56–62.

Give principal parts of *miserati*, *direxti.* Where were the *Syrtes?* Why does the poet use the word *fugientis* in this connection?

V. Sight Reading.

Translate:

Cæsar in eam spem venerat, se sine pugnae et sine volnere suorum rem conficere posse, quod re frumentaria ad-

versarios interclusisset. Cur etiam secundo proelio aliquos ex suis amitteret? cur vulnerari pateretur optime de se meritos milites? cur denique fortunam periclitaretur? praesertim cum non minus esset imperatoris consilio superare quam gladio. Movebatur etiam misericordia civium, quos interficiendos videbat; quibus salvis atque incolumibus rem obtinere malebat.

VI. Composition.

Translate into Latin:

But the enemy, as soon as they had seen our cavalry, the number of whom was five thousand, sent scouts (*speculator*) ahead to see where our camp was. When they saw that it was strong and that it could not easily be captured (*expugnare*), having posted guards they passed the night there. If they had not done so, they might have prevented us from the march, because the legion was too weak to set out if the enemy were near.

VII. History.

1. Give the dates, main events and results of the First Punic War.

2. In what battle did Hasdrubal fall? What battle closed the Second Punic War, with date and the commanders of the opposing armies?

3. Give an account of the Social War.

4. Give the life of Cicero.

5. Who composed the two triumvirates, and how were they brought to an end?

X.—GREEK.

I. Grammar.

1. Write correctly and give principle: *τέτριβται, πέπειθμαι, συνγενής, νύκτ'ὅλην, ἐξλέγω, οὐ οἶδα, ἐσταλσθε.*

2. Write contracted form of *γένεα, φοβέεσθε, τιμάη, δηλόητε, δηλόειν.*

3. Accent: *συνεχε, συνειχον, λειπων, λιπων, ἐτιμησας, τιμησας, ἦλθε, ἐλθε, παιδες τινες, ἀνδρες τινες, εἰ τις.*

4. Write the Acc. Sing. and Dat. Plur. of *ἀνήρ, γυνή, ἡδύς, πόλις, ὄρνις, λίων, χείρ, βασιλεύς.*

5. Compare *ἐχθρός, σώφρων, μέγας.* Form adverbs and compare, from *δίκαιος, ταχύς.*

6. Give a synopsis of the 2nd Aor. Pass. of *φαίνω*; the Aor. Act. of *δίδωμι*: Perf. Act. of *ἵστημι.*

7. Give principal parts of *φέρω, αἱρέω, γίγνομαι, στέλλω.*

8. Write the uncontracted and contracted forms of the Opt. Pres. Act. of *τιμάω.*

9. Write the Perfect and Pluperfect in full of *οἶδα.*

10. Distinguish between *βούλευσαι, βουλεῦσαι, βουλεύσαι.*

II. Xenophon.

1. Translate: *φίλους γε μὴν ὁσους ποιήσαιτο καὶ εὔνους γνοίη ὄντας καὶ ἱκανοὺς κρίνειε συνεργοὺς εἶναι ὁ, τι τυγχάνοι βουλόμενος κατεργάζεσθαι, ὁμολογεῖται πρὸς πάντων κράτιστος δὴ γενέσθαι θεραπεύειν. καὶ γὰρ αὐτὸ τοῦτο οὗπερ αὐτὸς ἕνεκα φίλων οἴετο δεῖσθαι, ὡς συνεργοὺς ἔχοι, καὶ αὐτὸς ἐπειρᾶτο συνεργὸς τοῖς φίλοις κράτιστος εἶναι τούτου ὅτου αἰσθάνοιτο ἕκαστον ἐπιθυμοῦντα.*

Explain construction of all optatives, infinitives, participles; also of *οὗπερ, φίλων, τούτου, ὅτου.*

Of whom was this said? On what occasion?

2. Translate: *ἐτύγχανον λέγων ὅτι πολλαὶ καὶ καλαὶ ἐλπίδες ἡμῖν εἶεν σωτηρίας. Πρῶτον μὲν γὰρ ἡμεῖς μὲν ἐμπεδοῦμεν τοὺς τῶν θεῶν ὅρκους, οἱ δὲ πολέμιοι ἐπιωρκήκασί τε καὶ τὰς σπονδὰς παρὰ τοὺς ὅρκους λελύκασιν. οὕτω δ' ἐχόντων, εἰκὸς τοῖς μὲν πολεμίοις ἐναντίους εἶναι τοὺς θεούς, ἡμῖν δὲ συμμάχους, οἵπερ ἱκανοί εἰσι καὶ τοὺς μεγάλους ταχὺ μικροὺς ποιεῖν καὶ τοὺς μικροὺς κἂν ἐν δεινοῖς ὦσι σώζειν εὐπετῶς, ὅταν βούλωνται.*

Explain construction of *λέγων, ἡμῖν, εἶεν, ἐχόντων, ὦσι.*

What is the Latin equivalent for the expression *οὕτω δ' ἐχόντων*?

Analyze the form *κἂν.* In line 2, why two *μεν*s?

By whom was this said? To whom? When? For what purpose?

3. Translate (at sight): "Νῦν τοίνυν," ἐφη ὁ Ξενοφῶν, "πάρειμι καὶ ἐγὼ καὶ οὗτος Φρυνίσκος εἰς τῶν στρατηγῶν καὶ Πολυκράτης εἷς τῶν λοχαγῶν, καὶ ἔξω εἰσὶν ἀπὸ τῶν στρατηγῶν ὁ πιστότατος ἑκάστῳ πλὴν Νέωνος τοῦ Λακωνικοῦ. εἰ οὖν βούλει πιστοτέραν εἶναι τὴν πρᾶξιν, καὶ ἐκείνους κάλεσαι. τὰ δὲ ὅπλα σὺ ἐλθὼν εἰπέ, ὦ Πολύκρατες, ὅτι ἐγὼ κελεύω καταλιπεῖν καὶ αὐτὸς ἐκεῖ καταλιπὼν τὴν μάχαιραν εἴσιθι."

III. Homer.

1. *Translate:*

Ζεῦ κύδιστε μέγιστε, κελαινεφές, αἰθέρι ναίων,
μὴ πρὶν ἐπ' ἠέλιον δῦναι, καὶ ἐπὶ κνέφας ἐλθεῖν,
πρίν με κατὰ πρηνὲς βαλέειν Πριάμοιο μέλαθρον
αἰθαλόεν, πρῆσαι δὲ πυρὸς δηίοιο θύρετρα,
Ἕκτόρεον δὲ χιτῶνα περὶ στήθεσσι δαΐξαι
χαλκῷ ῥωγαλέον· πολέες δ' ἀμφ' αὐτὸν ἑταῖροι
πρηνέες ἐν κονίῃσιν ὀδὰξ λαζοίατο γαῖαν.

Give Attic forms of words underlined.

Explain construction of ἐλθεῖν, βαλέειν, λαζοίατο (where found?).

1. *Translate:*

ἦ ῥα καὶ ἀμπεπαλὼν προΐει δολιχόσκιον ἔγχος,
καὶ βάλε Πριαμίδαο κατ' ἀσπίδα παντόσ' ἐΐσην.
διὰ μὲν ἀσπίδος ἦλθε φαείνης ὄβριμον ἔγχος,
καὶ διὰ θώρηκος πολυδαιδάλου ἠρήρειστο·
ἀντικρὺ δὲ παραὶ λαπάρην διάμησε χιτῶνα
ἐγχος· ὁ δ' ἐκλίνθη καὶ ἀλεύατο κῆρα μέλαιναν.
Ἀτρείδης δὲ ἐρυσσάμενος ξίφος ἀργυρόηλον
πλῆξεν ἀνασχόμενος κόρυθος φάλον· ἀμφὶ δ' ἄρ' αὐτῷ
τριχθά τε καὶ τετραχθὰ διατρυφὲν ἔκπεσε χειρός.

Write feet and quantities of first five lines.

On what occasion did this fight take place? Who were the combatants? What did they fight about? What was the result.

IV. History.

1. Give an account of the Athenian State before Solon.
2. Describe the expedition of Xerxes.
3. Give an account of the Sicilian expedition.
4. What can you say about Peisistratus? about Epaminondas?
5. Give an account of Demosthenes, and an estimate of his career.

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The number of graduates is 670, degrees having been conferred as follows:

Upon graduates of the School of General Literature: B. A., 38; B.S., 16; Ph.B., 7; M.A., 9.

Upon graduates of the School of Technology: C.E., 259; M.E., 130; B.M., 19; B.S. (in Mining and Metallurgy), 62; E.M., 58; E.E., 47; A.C., 76; B.S. (in Architecture), 4; M.S., 2; Ph.D., 1.

Of these, 1 has taken the degrees of B.A. and B.M.; 9 of B.A. and M.A.; 2 of B.S. and C.E.; 1 of B.S. and A.C.; 11 of B.M. and E.M.; 29 of B.S. and E.M.; 1 of B.M., E.M., and A.C.; 1 of B.S., E.M., and C.E.; 1 of C.E. and E.M.; 2 of A.C. and E.M.; 1 of A.C. and M.S.; 1 of A.C., M.S., and Ph.D. 641 graduates are still living.

* Deceased.

The following have been awarded certificates for the

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Elmer Ellsworth Boyer, '85, Foreman Arc Testing Department, Thomson-Houston Electric Co., Lynn, Mass.

Albert Brodhead, '88, 121 S. Centre Street, Bethlehem, Pa.

Edward Conner, '86, Philadelphia, Pa.

William Fairchild Dean, '88, Thomson-Houston Electric Co., 91 Warren Street, Lynn, Mass.

Horace Musser Engle, '85, President Montor Steam Generator Manufacturing Co., Roanoke, Va.

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Richard Otto Albert Heinrich, '88.

William Hoopes, '86, Superintendent Edison Electric Co.'s Station, West Chester, Pa.

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CONTENTS.

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